

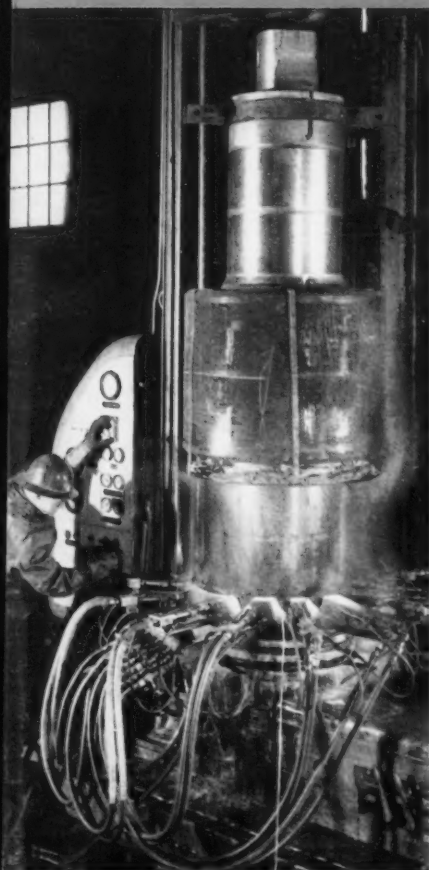
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PR15 '55

March-April 1955

# METAL TREATING



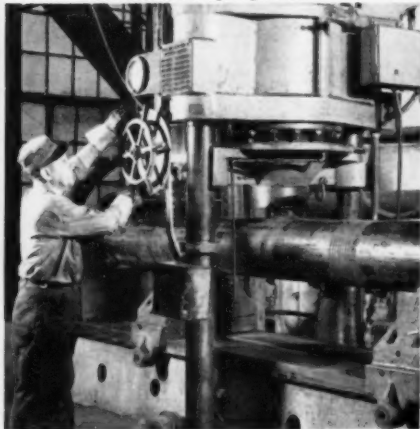
Typical facilities offered  
by the commercial heat treater.  
Photos courtesy of Pittsburgh  
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Hardening steel mill roll journals on a  
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A #2 Gleason Machine is used  
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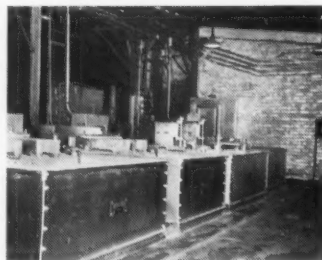
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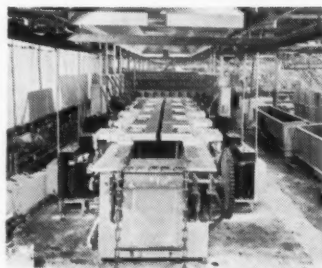
William F. Ross, who has had 17 years experience in this particular field, heads this new department.



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Vol. VI

No. 2

MARCH-APRIL 1955



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The presentation of editorial material in "Metal Treating" should not be interpreted as either an endorsement or recommendation by the Metal Treating Institute of the statements set forth.

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*Indexed in Engineering Index*

# METAL TREATING

## EDITORIAL

### RECOGNITION

We wonder if you, our readers, have been aware, as we have, how much more attention the technical societies and other national trade magazines have been devoting to "heat treating."

The number of feature articles which have been published on the subject, the number of papers and talks presented before association meetings, the development of special sections in some magazines devoted to the heat treatment of metals, all definitely indicate a truly worldwide recognition of the importance of our vital industry.

Some time ago, in planning their national and chapter meetings, the American Society of Tool Engineers surveyed their entire membership (31,000) and out of 56 separate topics suggested, heat treating had the number one position. As this is written, the society's West Coast Meeting is in progress in Los Angeles with a conference on heat treating an important part of the program.

In the fall of 1954, specific and separate meetings were scheduled by the American Society For Metals (membership 25,000) in connection with the Industrial Heating Equipment Association on the subjects of heat treating procedures and equipment. Similar sessions will be an important part of the Western Metals Congress of the ASM also in Los Angeles, March 28-April 1. The program reveals that ten papers will be presented.

All this adds up to the fact that heat treating is rapidly and forcefully beginning to assume the leading position in industry merited by its vital importance to production and recent scientific development and progress.

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# Practical Applications of

## FURNACE ATMOSPHERES

By Charles A. Mueller\*

**M**ost atmosphere heat treating operations use either endothermic, exothermic, dissociated ammonia, or dry nitrogen as atmospheres. The latter type is principally used in steel mill operations and for annealing.

An endothermic atmosphere is one which requires heat for reaction and will burn in air. An exothermic atmosphere, however, gives off heat in reaction and will not burn in air. The endothermic atmosphere finds its principal use in the following processes: hardening, brazing, sintering, and carbon correction. It is also an ideal atmosphere for homogeneous carburizing and, as a carrier atmosphere, in

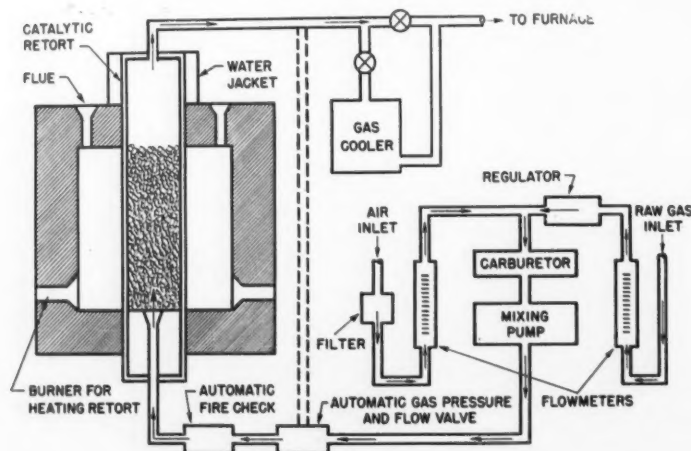
gas carburizing and carbonitriding by the addition of an enriching gas such as propane or natural gas. Fig. 1 is a schematic diagram of this type of atmosphere generator. The distinguishing features of this unit are: a retort that is externally heated and is filled with a nickel type catalyst, a mixing air-gas pump to proportion and deliver the air and gas to the retort, and, finally, pressure and temperature regulating equipment.

The exothermic atmosphere generator, Fig. 2, produces an atmosphere by partially burning natural, manufactured, propane, or butane gas with air over a catalyst. The air-gas mixture is

pumped through an automatic fire check into the combustion chamber. The water vapor from the partial combustion is condensed out of the reacted atmosphere and separated from the atmosphere by means of a water trap.

Exothermic atmosphere occasionally needs further purifying and drying for optimum results. During the summer months in certain locations, the temperature of the cooling water is high. The use of refrigeration is recommended where otherwise the dew point temperature of the atmosphere would be above 70°F. It is also necessary to remove sulphur from the atmosphere when the sulphur content in the raw gas supply is excessive (about 10 grains per 100 cu. ft.). The sulphur is removed by passing the atmosphere from the generator (containing sulphur in the form of hydrogen sulphide) over iron oxide. This atmosphere is used for bright annealing, normalizing or tempering of steel where decarburization is not a factor. It is also used for bright annealing of copper, for bright copper or silver brazing of steel where decarburization is not a factor, for silver brazing of non-ferrous metals and alloys such as copper, bronze, and brass, and for sintering of non-ferrous and low carbon steel mixtures in powder metallurgy.

The atmosphere generator for producing a dry hydrogen-nitro-



SCHEMATIC FLOW DIAGRAM FOR HYEN ENDOTHERMIC GENERATOR

Fig. 1—Construction details of an endothermic atmosphere generator are shown here schematically. Note that the air-gas mixture is fed into a heated retort and not burned as shown in Fig. 2.

\*At the time this article was written the author was associated with Lindberg Engineering Co.



gen mixture does so by completely dissociating anhydrous ammonia into its components of hydrogen and nitrogen (Fig. 3). No air is used in the process; the raw ammonia gas is passed over a heated catalyst to produce this atmosphere. Suitable pressure and temperature regulation of the process results in an atmosphere that is consistently 99.99% dissociated and has a dew point temperature of  $-60^{\circ}\text{F}$ .

tain protection at doors, improved retort seals, door seals, and full muffle designs. However, some atmosphere contamination always occurs during loading operations. This contamination may come from room air, the products of combustion from door curtains, entrapped air in the furnace load, oxides on the work, and moisture. Fig. 4 shows the results of opening the furnace door

## Applications to Heat Treating Processes

### Oxide reduction during annealing:

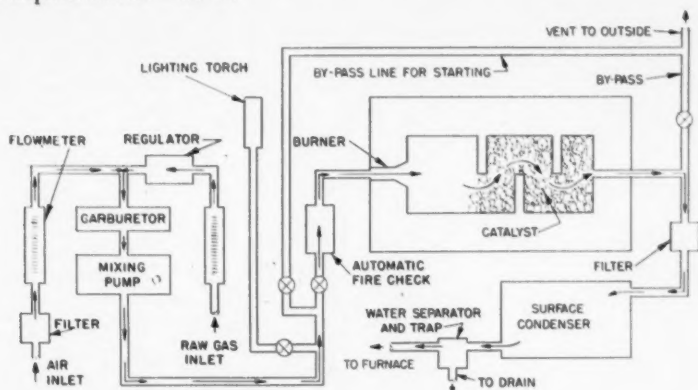
The effectiveness of certain atmospheres to reduce forging scale is receiving considerable attention. Reduction of forging scale is desired in order to increase tool life during subsequent machining operations. In one instance where automotive drive pinion forgings were being annealed, the scale reduction was simultaneously carried out under atmosphere control. Exothermic type atmosphere having the following composition was being used.

Carbon dioxide	4.5%
Carbon monoxide	12.0%
Hydrogen	18.0%
Methane	1.0%
Nitrogen	Balance

The scale reducing properties of this atmosphere were not completely satisfactory, so a small amount of endothermic atmosphere was added. This mixed atmosphere greatly improved the reduction of oxides with consequent lengthening of tool life. Fig. 5 shows the amount of oxide reduction in relation to the hydrogen content of the atmosphere.

### Homogeneous carburizing:

Homogeneous carburizing is a



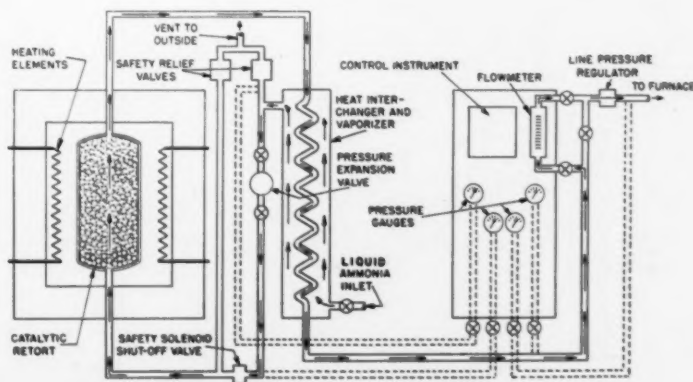
SCHEMATIC FLOW DIAGRAM FOR HXEX HYDRIDING GENERATOR

Fig. 2—Partial burning of an air-gas mixture is a distinguishing feature of the exothermic atmosphere generator shown here.

Dissociated ammonia atmosphere is used for the bright annealing of electric metals, bright hardening and annealing of stainless steel, sintering and reducing powder metals, particularly those refractory metals and alloys such as tungsten and tantalum carbides, and as an effective low cost substitute for cylinder hydrogen. Atmospheres high in percentage of carbon monoxide are liable to cause carbon precipitation at low temperatures during heating or cooling; therefore, purified and dried high nitrogen atmospheres or dissociated ammonia atmosphere is used. These latter type atmospheres are not needed for bright annealing or stress relief because the time of cooling is short.

Furnace manufacturers have utilized numerous ingenious methods to preserve the purity of the atmosphere in the furnace. Among these are: continuous welded furnace shells, flame cur-

to charge a standard box type tool hardening furnace. Continuous checking of the atmosphere dew point temperature showed that stability was practically complete in three minutes with normal atmosphere flow. Lesser volumes of atmosphere required longer recovery time.



SCHEMATIC FLOW DIAGRAM FOR HYAM HYDRIDING GENERATOR

Fig. 3—Details of an atmosphere generator for the dissociation of ammonia into nitrogen and hydrogen.

form of gas carburizing which is discussed in detail later. The economics of using low carbon steel for certain formed parts and then heat treating to secure high carbon steel performance has been proved in many applications. This method takes advantage of the formability and low cost of the original steel. During heat treatment, the parts are surrounded by an atmosphere of suitable composition to raise the carbon content of the steel throughout its entire section to a desired level. This may be done simultaneously with heating for quench hardening. Carefully controlled endothermic atmosphere is used. A manufacturer of fasteners random-loads his parts in baskets which are pushed through the furnace. Sequence timers activate an ejector and tilting mechanism at the discharge end of the furnace. The parts are oil quenched and then removed from the quench tank on a mesh belt flight conveyor. The work

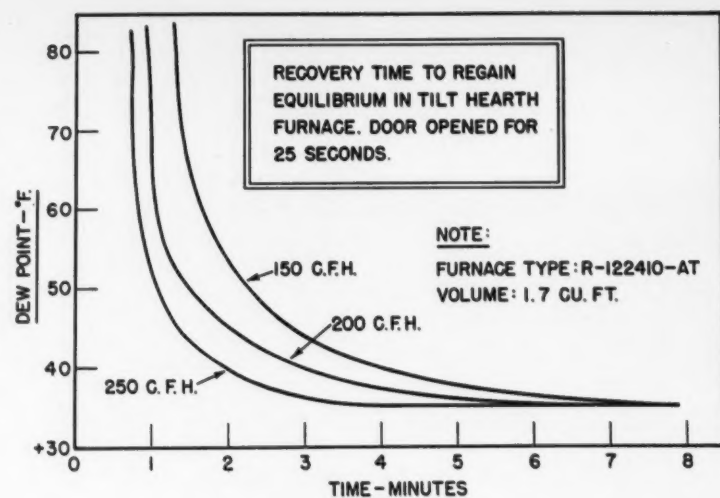


Fig. 4—Time required to regain atmosphere equilibrium after opening furnace door. Increasing volume of atmosphere decreases recovery time.

baskets are not quenched, but are discharged through a side door where they return to the loading position by gravity rollers. All operating cylinders are hydraulic for smoothest possible action. Fig. 6 shows the furnace and quench tank.

#### Carbon restoration:

This process preceded the development of homogeneous carburizing and was responsible for much data concerning the equilibrium relationships between steel and furnace atmosphere. A series of charts were prepared which show the equilibrium temperature of endothermic atmosphere.

Fig. 7 shows the carbon equilibrium relationship between straight carbon steel and the dew point temperature of endothermic atmosphere. Figs. 8 and 9 show the relationships with various production steels and tool steels. The percent carbon in the steel is shown along the base line; 0.30% C. is at the left hand end of the chart, higher carbon content of the steel is shown toward the right. The dew point temperature in the furnace is shown along the vertical scale running from 0° F. to plus 70° F. The top line on this chart represents various straight carbon steels treated at 1500° F.; the other lines represent treatment at temperatures of 1600° F. to 2100° F. in 100° F. increments of temperature. The curves show that progressively lower dew point temperatures are required for increasing carbon potential; this is the meaning of the downward course of all

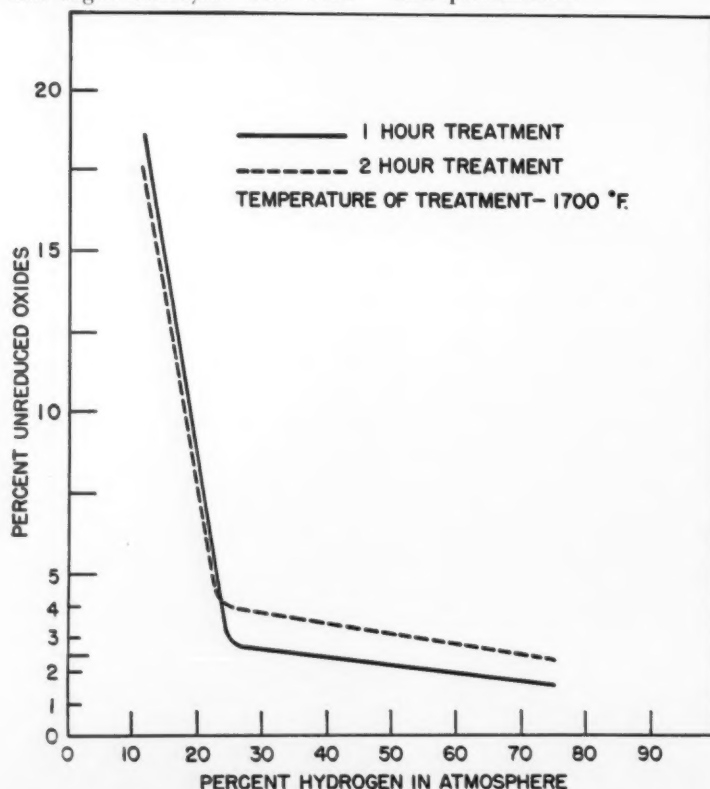


Fig. 5—Relationship of hydrogen in furnace atmosphere to amount of oxide. Note that increasing amount of hydrogen is far more effective than increasing time in furnace.

lines toward the right hand end of the chart. Notice also that progressively lower dew point temperatures are required at increasingly higher furnace temperature for the same carbon potential.

Fig. 8 shows some of the production steels similarly investigated. Here, temperature is shown on the horizontal axis increasing toward the right hand side. Dew point temperature is shown on the vertical axis. The chart shows again that the dew point temperatures must be lower as the furnace temperature increases in order to secure carbon equilibrium. Fig. 9 shows the dew point temperature requirements for a wide selection of tool steels. The data was prepared by treating representative samples from each of the major classifications of tool steels. The left hand column lists tool steel classifica-

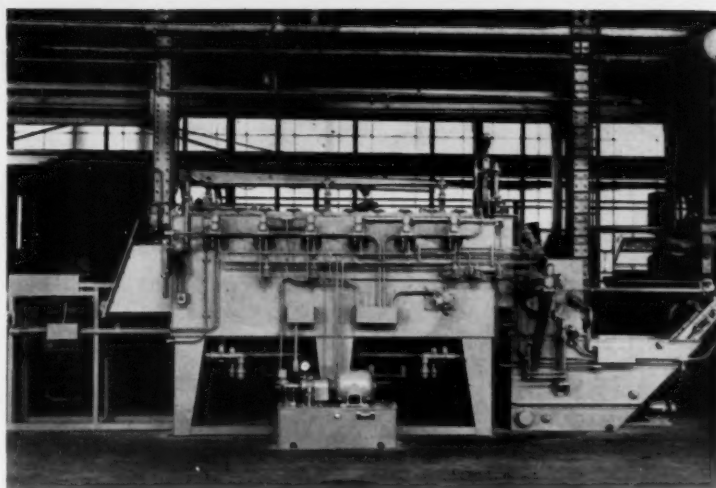


Fig. 6—Mechanized furnace used for homogeneous gas carburizing and hardening.

tions, the next column shows the normal hardening temperature and the last column lists a typical tool steel from each classification. Dew point temperature is shown along the horizontal axis, increas-

ing to the right. The heavy line represents the exact equilibrium dew point temperature and the shaded portion represents the permissible range for satisfactory results.

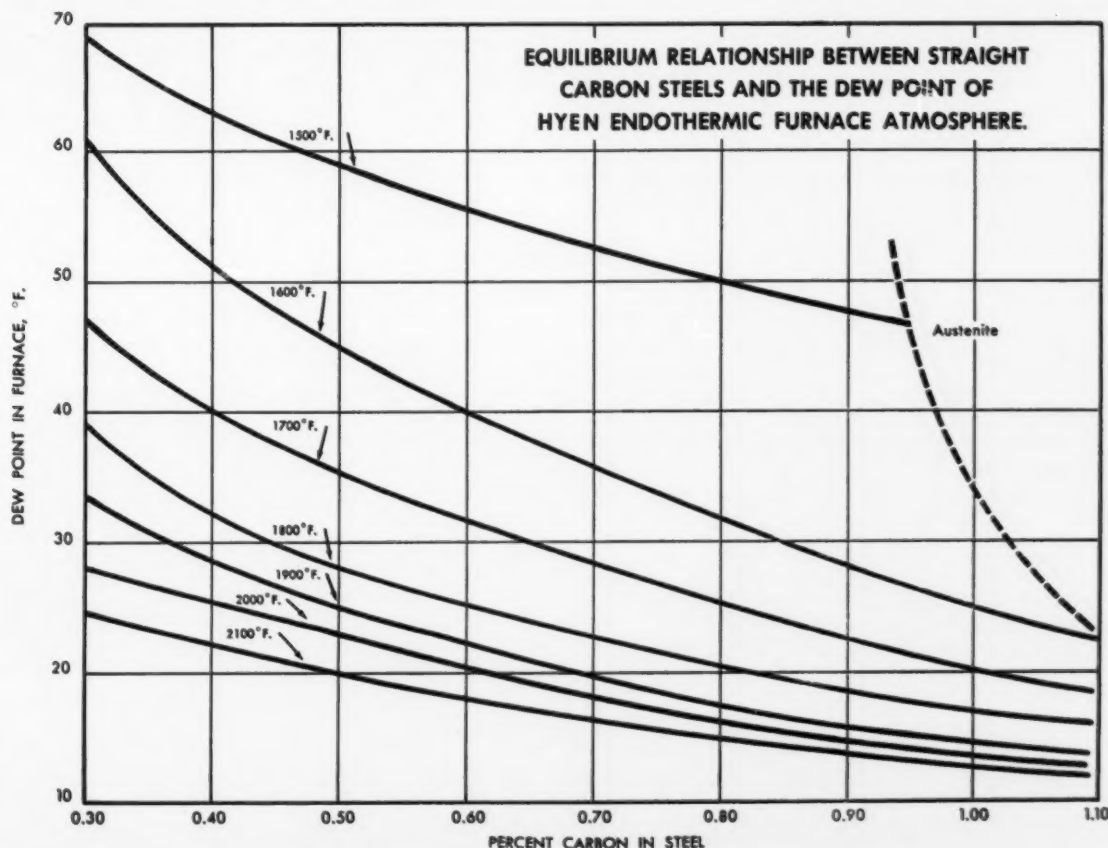


Fig. 7—Equilibrium relationships between straight carbon steels and dew point of endothermic atmosphere at different temperature levels.

The information contained in Figs. 7, 8, and 9, may be used for neutral hardening, carbon correction, homogeneous carburizing, and deep case carburizing.

#### Neutral Hardening

The dew point temperature of the atmosphere in the furnace is maintained at the setting indicated for the hardening temperature of the steel being treated. Fig. 9 shows that it is not necessary to adjust the dew point closer than  $\pm 5^\circ \text{F.}$ ; this will usually give perfect results as checked by the hardness tester. For example, when hardening a tool of manganese oil hardening steel, a dew point temperature of

$45^\circ \text{F.}$  to  $55^\circ \text{F.}$  is maintained during treatment at  $1450^\circ \text{F.}$

#### Carbon Correction

Equilibrium curves are particularly useful in the carbon correction of steel. Carbon correction may be done simultaneously with regular heat treatment processes. For example, if an SAE 4140 steel were being heat treated and simultaneously carbon corrected, a hardening temperature of  $1600^\circ \text{F.}$  would be used. Fig. 8 shows that a furnace dew point temperature of  $55^\circ \text{F.}$  would be in equilibrium with this steel. The length of time that the parts would be held at  $1600^\circ \text{F.}$  would depend on the depth of

the decarburized layer. Usually a soak about twice that needed for normal hardening is required, according to metal thickness.

#### Homogeneous Carburizing

In this process, which carburizes a low-carbon steel throughout to a uniformly higher carbon, the equilibrium curves may also be used. For example, homogeneous carburizing to a 0.70% carbon content for spring properties should be done under equilibrium conditions for 0.70% carbon. Fig. 7 shows that this can be done at  $1600^\circ \text{F.}$  with a furnace dew point of  $35^\circ \text{F.}$  or at  $1550^\circ \text{F.}$  with a furnace dew

(Continued on page 28)

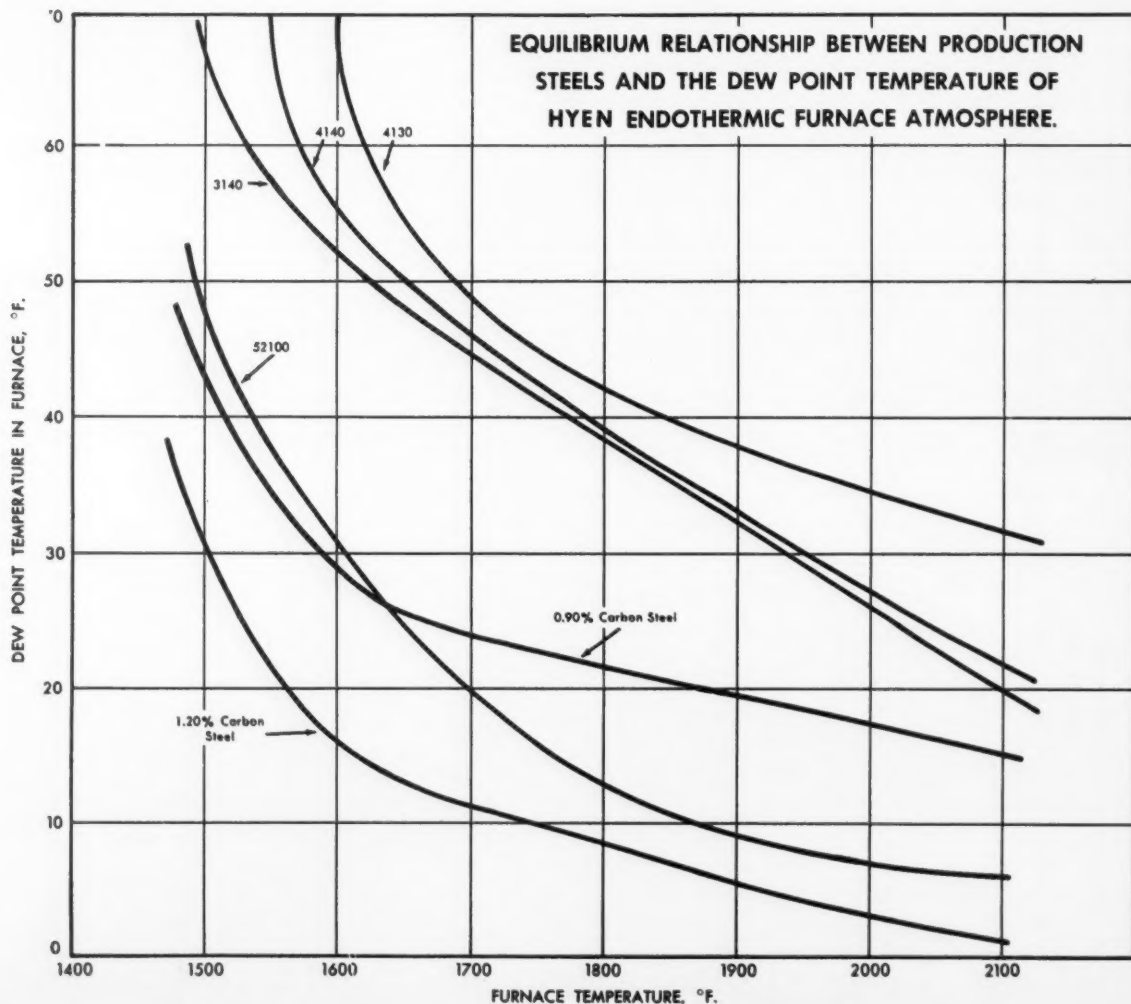


Fig. 8—Equilibrium relationships for various production steels.



**CLASSIFICATION  
OF  
TOOL STEEL**

**HARDENING  
TEMPERATURE  
°F**

Chromium, Tungsten, Molybdenum Hot Work Die Steel . . . . .	.1850
Chromium, Moly. Steel—5% Cr.— 1% Mo.—1% C. Air Hardening . . .	.1750
Silicon, Manganese Steel Chisel, Shock-Resisting . . . . .	.1550
Manganese Non-Deforming Oil Hardening Die Steel . . . . .	.1450
High Carbon—High Chromium Oil Hardening Type . . . . .	.1750
Low Tungsten, Chromium-Tungsten Chisel Shock-Resisting Steel . . . .	.1750
High Carbon—High Chromium Air Hardening Type . . . . .	.1850
Tungsten Fast Finishing Steel . . . . .	.1550
Carbon-Vanadium Shallow Water Hardening Die Steel . . . . .	.1500
High Carbon—Low Tungsten Oil Hardening Steel . . . . .	.1550
Chromium, Nickel, Molybdenum Steel. . . . .	.1500
Tungsten High Speed Steel 18-4-1 Type . . . . .	.2350
Molybdenum High Speed Steel 5-5-5 Type . . . . .	.2250

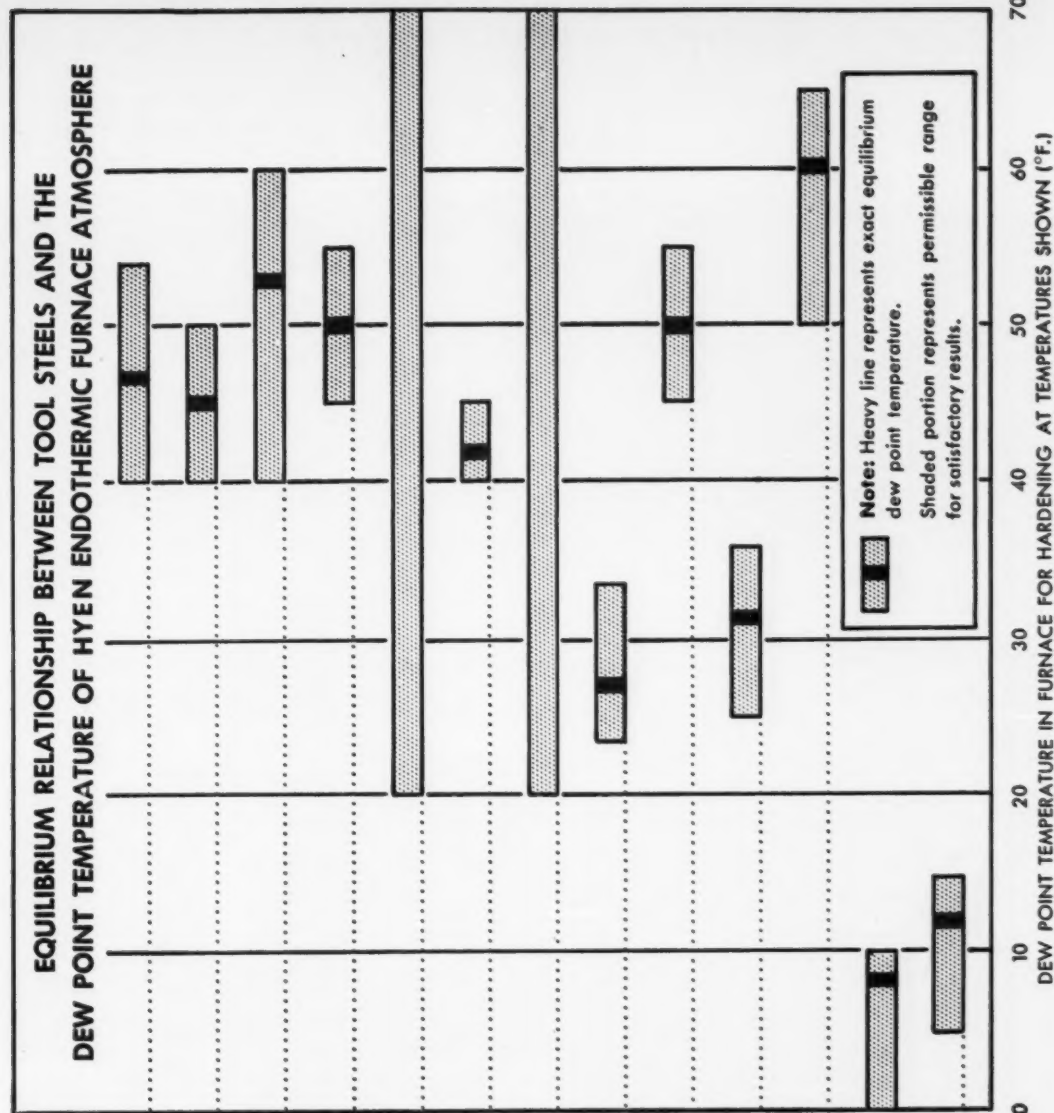
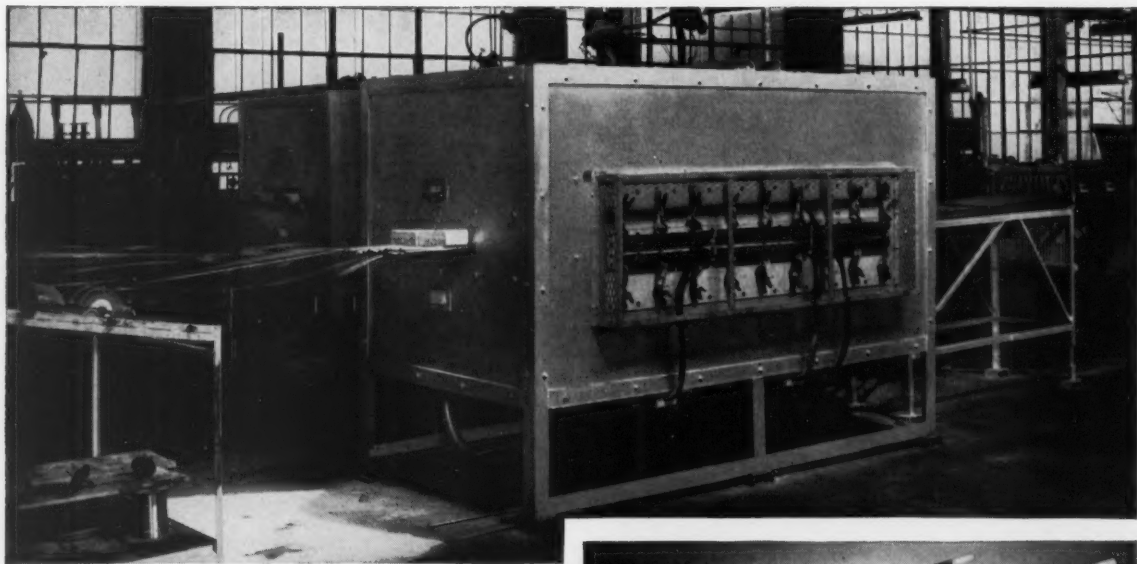


Fig. 9—Equilibrium relationships for a variety of tool steels giving general classifications and hardening temperature.

# More proof that "HOT RODS" last 3 times longer



Completely Equipped With "Hot Rods" after Norton CRYSTOLON heating elements proved their ability to outlast others 3 to 1. This electric furnace is one of a battery operated by the Alloy Metal Wire Division of H. K. Porter Company, Inc. of Prospect Park, Pa., for bright annealing alloy wire at 2150F. Heating elements operate in an air atmosphere, while the wire passes through tubes containing a controlled split-ammonia atmosphere. These furnaces idle at 1700F-1750F on weekends and holidays, so element service is continuous.

**Alloy Metal Wire Division  
H. K. Porter Company, Inc. converts  
to CRYSTOLON\* heating elements  
after tests prove superiority  
of latest Norton R<sub>x</sub>**

Like many another new user of "Hot Rods" the Alloy Metal Wire Division of H. K. Porter Company, Inc. found that these Norton CRYSTOLON heating elements last much longer. Here is a summary of the tests responsible for this company's decision to make a complete change-over to "Hot Rods."

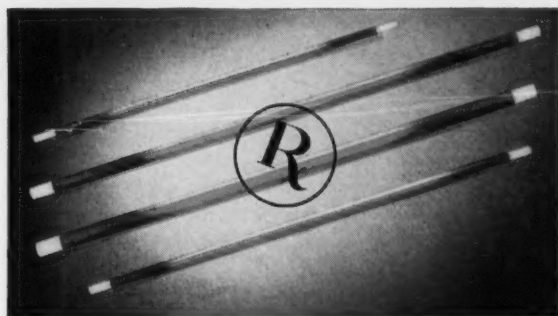
*Electric furnaces at the company's Prospect Park plant are used for bright annealing alloy wire at 2150F. Previous heating elements had given approximately 4 to 6 months service with 3,048 hours as the best recorded service life. Then, in a furnace completely equipped with "Hot Rods" the Norton elements averaged 18 months of continuous service — or over 13,000*

*hours per element. Once again "Hot Rods" proved their ability to outlast competitive elements — by better than 3 to 1!*

But that's not the whole economy-story. The much longer life of "Hot Rods" also means savings in element costs, because fewer "Hot Rods" are needed — *plus* reduced maintenance, due to less frequent changing — *plus* fewer changes in voltage taps — *plus* a smoother production flow.

**Put these advantages  
to work for YOU**

in your own electric furnaces or kilns. The big illustrated booklet, *Norton Heating Elements*, gives complete details. For further information circle No. 6



Norton CRYSTOLON Heating Elements, or "Hot Rods", are a typical Norton R<sub>x</sub> — an expertly engineered refractory prescription for greater efficiency and economy in electric kiln and furnace operation. Made of self-bonded silicon carbide, each rod has a central hot zone and cold ends. Aluminum-sprayed tips and metal-impregnated ends minimize resistance and power loss. Available in standard sizes.

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# SOLVING A DISTORTION PROBLEM

By **THOMAS A. DICKINSON**  
*West Coast Reporter*

**A** knotty distortion problem recently had to be solved by engineers at U. S. Steel's Consolidated Western Steel Division, Berkeley, Calif., in order to heat treat long lengths of large diameter stainless steel pipe for a severe corrosion application in an Atomic Energy Commission project.



Fig. 1—Minimum distortion resulting from heat treatment of these long lengths of large diameter stainless steel pipe is noted in this before-and-after photo. Pipe at left has just come from furnace and water quench. Others are being moved to furnace.

The pipe, of 36" diameter, was fabricated in 30' lengths from  $\frac{3}{8}$ " and  $\frac{1}{2}$ " thick 18-2 stainless steel plates which were made in conformity with ASTM specification A-240. Each plate was first rolled into a "can" 7' 6" long and 36" in diameter. The cans were then welded together in groups of four to form the 30' lengths of pipe by means of the automatic submerged-arc process. The fabrication by forming and welding lowered the corrosion resistance of the 18-8 stainless steel to such an extent that a full anneal heat treatment was required.

This treatment consisted of heating the pipe to 1850-2050° F. for 30 minutes and rapidly quenching it in water.

To prevent the re-precipitation of chromium carbides along the grain boundaries, it was necessary to reduce the temperature of the steel from the annealing temperature to less than 800° F. in 2 to 3 minutes.

The special handling fixtures shown in Figs. 1 and 2 were devised for the purpose of minimizing distortion due to such rapid quenching. The 30-ft. lengths of pipe were heat treated two at a time in a horizontal, top-opening, gas fired furnace at the Oscar Krenz, Inc., plant, Berkeley, Cal.

Test plates, 12" square, were welded as a continuation of the longitudinal seam on one "can" section for every other length of pipe. After annealing, the mechanical properties of the weld were evaluated by face, root, side bend, and tensile tests. The minimum tensile strength required was 75,000 psi.

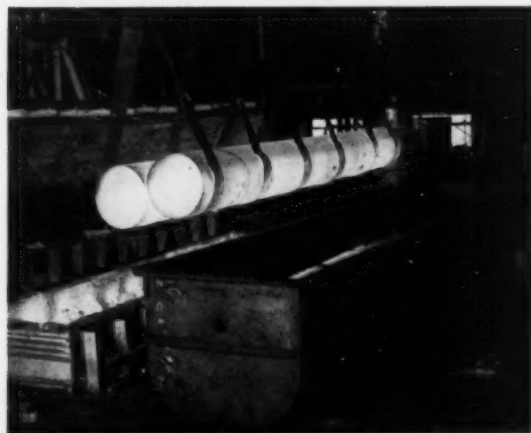


Fig. 2—Special handling techniques prescribed by engineers at U. S. Steel's Consolidated Western Steel Division averted excessive distortion of these long lengths of large diameter stainless steel pipe at the high temperature required in post fabrication heat treatment.

Following the heat treatment, minor distortions in the pipe were removed by re-rolling. Each length of pipe was then given a hydrostatic test; the  $\frac{3}{8}$ " wall was tested to 480 psi. and the  $\frac{1}{2}$ " wall tested to 640 psi. ■ ■ ■

# BATCH CARBON RESTORATION ANNEALING OF BAR STOCK

By H. W. CALLAHAN, Superintendent  
Cold Finishing Department,  
Jones & Laughlin Steel Corporation  
Pittsburgh, Pennsylvania

The marketability of any item or commodity is always enhanced when it becomes possible for the manufacturer to offer the customer a better product. This amounts to an overall savings for both. The production of cold finished bar stock in surface carbon restored condition at the Pittsburgh Works, Hazelwood Plant of the Jones & Laughlin Steel Corporation, is a good example. Previously this type of bar stock required costly operations to remove the decarburized surface before further processing could proceed. Now, these extra operations are eliminated resulting in a more uniform bar stock with some improved machinability characteristics in the higher carbon grades.

To achieve and maintain this uniformity, material from the J & L cold finishing mills, requiring thermal treatment, are now processed in a radiant tube, controlled-atmosphere, car bottom type furnace designed and built by the Surface Combustion Corporation of Toledo, Ohio. (Fig. 1)

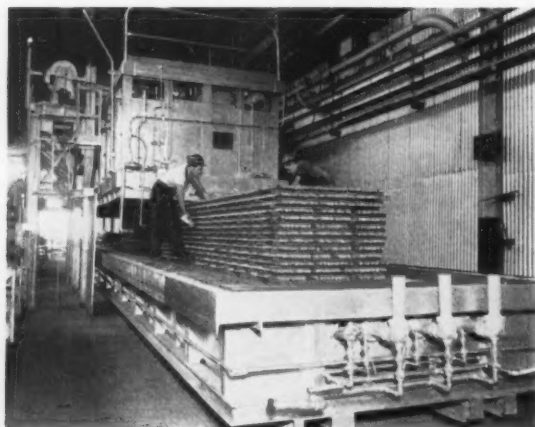


Fig. 1—Operators adjusting spacers in typical carbon restoration—anneal charge of hot rolled bar stock. Note radiant tube burners and flexible gas and air connections in end of car. Three tubes are also located in opposite end of car.

Rounds, hexagons, flats, and squares are treated as straights or coils which are loaded directly on the furnace hearth stools. The straights range in size from  $\frac{1}{2}$ " to 12" in diameter, and coiled stock sizes range up to  $\frac{3}{8}$ " in diameter, with coil diameters of up to 40".

Stock is in either a pickled and limed, or cold drawn condition before being treated. Surface decarburization ranges from .005 to .032 inches in depth, before heat treatment.

Steel grades, which are also varied, range from the low carbons such as C-1008, C-1015, and C-1020 to the high carbon grade C-1095, and various alloy grades.

The basic principles and theory of reactions and inter-reactions encountered in controlled atmosphere heat treatments, both reactive (gas carburizing, carbon restoration) and protective (bright annealing), will not be discussed in detail at this time as they have been thoroughly covered and described in detail in several notable published reports embracing extensive research and successful application.

The following will best summarize the principal heat treatments carried out in this batch controlled atmosphere furnace, by describing them in conjunction with the types of steels and range of stock sizes predominant for each process.

## Carbon Restoration—Annealing

- Purpose** —Restoration of carbon to the decarburized surface of "hot rolled" bar stock, pickled and limed.
- Sizes** — $2\frac{1}{32}$ " diameter and over.
- Grades** —AISI C-1035 to C-1050, C-1137 to C-1144.
- Charge** —15 to 30 tons per load.
- Loading** —"Layer" loading (See Fig. 1)
- Cycle** —Heat to 1200°F. in NX (exothermic) protective gas. Add natural gas. Switch to RX (endothermic) reactive atmosphere enriched with natural gas, at 1400°F. Soak six hours at 1650°F. Reduce natural gas during soak. Force-cool charge in furnace on automatic program control. Switch to NX atmosphere at 1400°F. Uncover load at 1100°F.

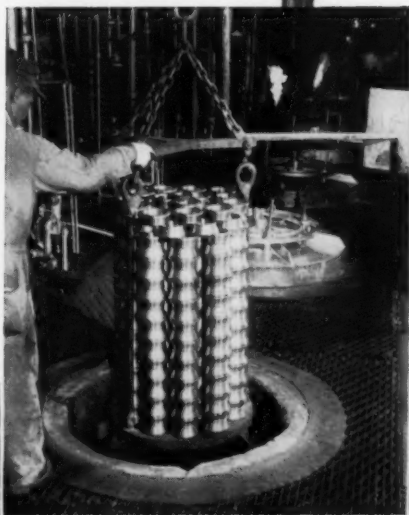
**Results** —Complete freedom from decarburization. Usual practice attains a carbon limit of 10 to 15 points above ladle carbon. The carbon content at surface

(Continued on page 12)



# Service life doubled ...with Inconel

**How The Timken Company makes fixtures that stand 2700 hours of carburizing and oil quenching**



How long do *your* quenching fixtures last? And how much do they have to take? Perhaps the experience of The Timken Roller Bearing Company can help you save on replacement costs.

Roller bearing parts at The Timken Company are carburized in natural gas. This heat treatment is followed by an immediate oil quench.

During the whole process the parts are carried on a fixture consisting of three Inconel® eye-bolts welded to a grid. Formerly, under the corrosive conditions and severe thermal shock, eye-bolts only lasted an average of 1350 hours.

With Inconel, The Timken Company finds the service life of these eye-bolts has been doubled, and better. Some last up to 3700 hours.

*This is possible because of Inconel's combination of valuable properties: its strength at high temperatures, its excellent resistance to oxidation and corrosion, and to thermal shock.*

With these factors present, fabricated, well designed Inconel equipment is the logical choice for heat treating service followed by quenching. Of further importance, Inconel, despite its strength and toughness, can be readily formed. It is also easy to weld by any of the commonly used methods.

Try Inconel. You'll find, like The Timken Roller Bearing Company, that it is a high temperature alloy that gives long service under severe conditions. And for many suggestions on practical ways to make Inconel heat treating equipment write for our booklet, *Keep Operating Costs Down . . . When Temperatures Go Up*.

The INTERNATIONAL NICKEL COMPANY, Inc.  
67 Wall Street New York 5, N. Y.



**Nickel Alloys**



## Inconel . . . for long life at high temperatures

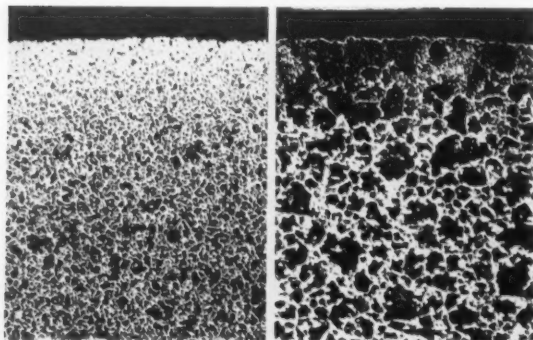
For further information circle No. 3

is determined by ring checks on representative samples from each charge. Typical examples are shown in the photomicrographs in Figures 2A and 2B.

#### Annealing—(Before Cold Drawing)

- Purpose** —To decrease the hardness of bars before cold drawing to satisfy specific customer, or processing requirements.
- Sizes** —All sizes and shapes of straights, pickled and limed hot rolled bars.
- Grades** —C-1040 to C-1095, and high carbon re-sulphurized grades.
- Charge** —20 to 40 tons per load.
- Loading** —“Lift” or bundle loading.
- Cycle** —Heat to 1200°F. in NX atmosphere. Add natural gas. Soaking period, temperature, and cooling rate determined by grade and application.
- Results** —Substantial decrease in hardness as shown:

Grade	Size	Brinell Hardness	
		As Rolled	Annealed
C-1050	27 32 x 7 32" Flat	228	163-166
C-1060	23 32" Round	262	146-155
C-1080	2.005 x .205" Flat	321	212



A.) C-1045 round—1 1/8" stock diameter. Coarse grain. Ladle carbon 0.45% (75 x 4% Nital etch) A .015" ring test results—0.30% carbon "as rolled" and 0.57% carbon after carbon restoration-anneal.

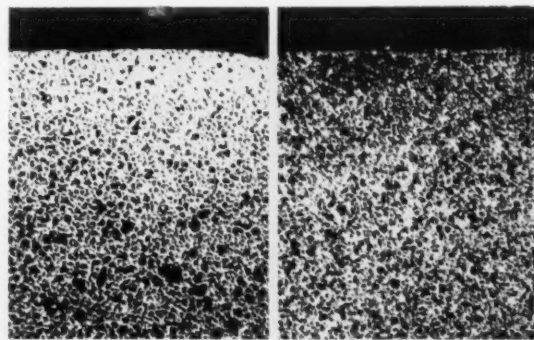
oxidizing temperature. Uncover load at approximately 200°F.

**Results** —Complete elimination of cold work hardness while retaining cold drawn finish and size.

#### Normalizing

- Purpose** —To relieve stresses developed in rolling or forging operations.
- Sizes** —1 1/2" diameter and up, large forged shafts.
- Grades** —Intermediate and plain carbon, plus low alloy grades.
- Charge** —15 to 30 tons per load.
- Loading** —“Layer” loading of pickled and limed hot rolled or forged stock.
- Cycle** —Soak 4 to 8 hours (dependent on stock size) in NX atmosphere at temperature 50°F. above upper critical. Pull charge and air cool.
- Results** —Uniformity of structure and physical properties.

Although continuous furnaces are ideal under large scale production conditions where relatively constant material and process requirements exist, batch production is the most practicable where overall volume is often large, but job-lot, and where



B.) C-1045 round—1 13/16" stock diameter. Fine grain. Ladle carbon 0.48% (75 x 4% Nital etch) A .015" ring test results—0.28% carbon "as rolled" and 0.59% carbon after carbon restoration-anneal.

Fig. 2—Typical before and after photomicrographs of carbon restoration annealing results

#### Bright Annealing

- Purpose** —Relieve the cold working stresses, while retaining dimensional accuracy and surface finish of cold drawn stock.
- Sizes** —All sizes and shapes.
- Grades** —Most free machining grades.
- Charge** —20 to 40 tons per load.
- Loading** —“Lift” or bundle loading.
- Cycle** —Soaking period, temperature, and cooling rate determined by grade and application. Cool in furnace to below

the material and process requirements are highly varied.

#### Basic Operating Procedure

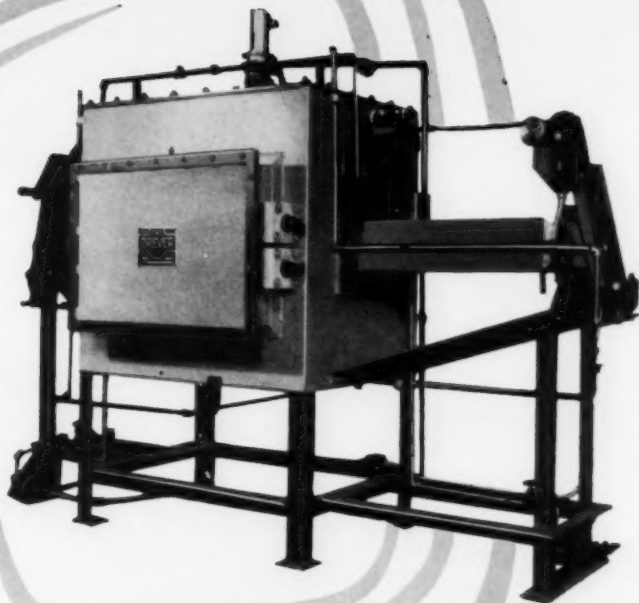
For most processing, steel bars are “layer” loaded in such a manner that the prepared atmosphere can readily contact the entire surface of the steel being treated. (See Fig. 1) To accomplish this, 1 1/8" diameter spacer bars are used between each layer of bars. The bars are usually stacked to a

(Continued on page 14)

# DREVER

## Batch Type

## Sintering Furnaces



## Powdered Metals

Shown is a controlled atmosphere batch type push-thru furnace with water cooled cooling chamber, rated 20-KW having an average production of 20 to 30 pounds per hour.

Furnaces are suitable for sintering and infiltration of powder metal parts and for reduction of metal powder oxides.

Other sizes of batch type and continuous sintering furnaces are also available.



RED LION ROAD AND PHILMONT AVE., BETHAYRES, PA.

## *The Metal Treating Institute*

### *Annual Achievement Award*

*To be made at the discretion of a Committee appointed to select the Best Article appearing in Metal Treating magazine or Lecture presented at any meeting of the Institute.*

*This year's award shall be presented at the 1955 Annual Meeting of the Institute and all Articles appearing in any issue of Metal Treating from September - October 1954 to July - August 1955, or any Lectures presented at the 1954 Annual and 1955 Spring Meetings are eligible for consideration.*

#### **Award Committee—**

C. M. Cook, President, Metal Treating Institute

H. N. Bosworth, Chairman, Research and Awards Committee

H. C. Knerr, Chairman, Publication Committee

Fred Heinzelman, Jr., N. R. Hodgson, Michael Kober, L. G. Field; members, Publication Committee

C. E. Herington, Editor, METAL TREATING

height of about 37" to 38". The furnace loads vary from 36,000 to 85,000 pounds per charge. Temperature variation is less than 20°F. at the end of the soaking period. Four thermocouples are placed at different levels along the length of the furnace charge to check work temperature. (See Fig. 3)



Fig. 3—Thermocouples placed at strategic points in each charge keep careful check on temperature distribution throughout each load. Note that heating cover is "down" on other car.

Annealing up to 1200°F. is carried out in straight NX gas (2500 cfh). Above this temperature a fixed amount of enriching natural gas is added to prevent any decarburization. Enriching gas is always turned off for a definite period before raising furnace cover.

#### **Prepared Atmosphere Generators**

Two Surface Combustion prepared atmosphere generators furnish all of the protective (NX-exothermic) and reactive (RX-endothermic) controlled atmosphere capacity required for all processing. Both units are situated adjacent to the furnace and are manifolded to the lift cover.

The NX generator of 2500 cfh capacity produces an atmosphere of the following composition for use during heating up and cooling periods during carbon restoration, and also for bright annealing:

	<i>Lean</i>	
CO <sub>2</sub>	Less than	.1%
CO	Less than	2.0%
H <sub>2</sub>	Less than	2.0%
N <sub>2</sub>		96.0% or over

The RX generator of 2400 cfh capacity produces the reactive atmosphere for use during the active period of carbon restoration. Its analysis is essentially CO—20.0%, CH<sub>4</sub>—0.4%, H<sub>2</sub>—40.0%, and N<sub>2</sub>—39.6%. For determination of carburizing potential an automatic dewpoint recorder is used. Both generators are equipped with safeguards that automatically shut down each unit in case of utility failure. ■ ■ ■





# Now! Vastly Improved Quenching with Salt!

**ANY** steel that can be hardened by oil quenching can now be martempered or austempered in the new Ajax Cataract Quench Salt Bath Furnace . . .

*...with equal hardness and with all of the PLUS heat treating advantages that only molten salt can give.*

This new Ajax Electric Salt Bath Furnace with its vastly increased cooling rate permits rapid quenching of steel parts through their critical temperature range.

Tremendous quenching power is obtained by an adjustable-speed pump. The downward flow of salt into the quenching header can be regulated for various hardenabilities.

Send specimen work to the Ajax Metallurgical Service Laboratory for a process demonstration—preferably in your presence . . . No obligation.

## **AJAX CATARACT QUENCH FURNACE**

**Provides greater quenching power than previously possible.**

**Permits heavy sections** to be martempered and austempered. (Sections up to 6" diameter, can be martempered and sections up to 1 1/4" diameter austempered).

**Assures high and uniform hardness.**

**Eliminates excessive distortion** — As a rule, parts can be finish-machined before hardening.

**Avoids danger of quench cracking.**

**Increases toughness and ductility.**

### **Write for Bulletin 700**

"Ajax Cataract Quench Furnaces," and Technical Bulletin 500, "The Present Status of Austempering and Martempering."



# AJAX

HULTGREN

Associated Companies: Ajax Electric Furnace Corp.;  
Ajax Electrothermic Corp.; Ajax Engineering Corp.

**electric SALT BATH furnaces**

**AJAX ELECTRIC COMPANY, 940 Frankford Avenue, Philadelphia 23, Pa.**

For further information circle No. 5

# Right or Wrong In

## LABOR RELATIONS

By LAWRENCE STESSIN

### Editors' Note:

*This department presents, in each issue, a round-up of day to day in-plant problems and how they were handled by management. Each incident is taken from a true-life grievance which went to arbitration. Sources of these cases will be given upon request.*

*Can you fire an employee who phoned he was sick and then went out and played poker until 5:00 A.M.?*



### What Happened:

Bradley, a seven-year man, telephoned his foreman one Friday and reported ill. That night the plant superintendent heard that Bradley was up until 5 A.M. playing poker in the Union Hall. Two days later Bradley showed up for work with a doctor's certificate. The superintendent was out of town but Bradley was told that the boss had left word that Bradley should be fired when he came back to his job. The superintendent had said that if Bradley were well enough to play poker until 5:00 A.M. he was well enough to come to work.

Was the Superintendent: Right ☐ Wrong ☐

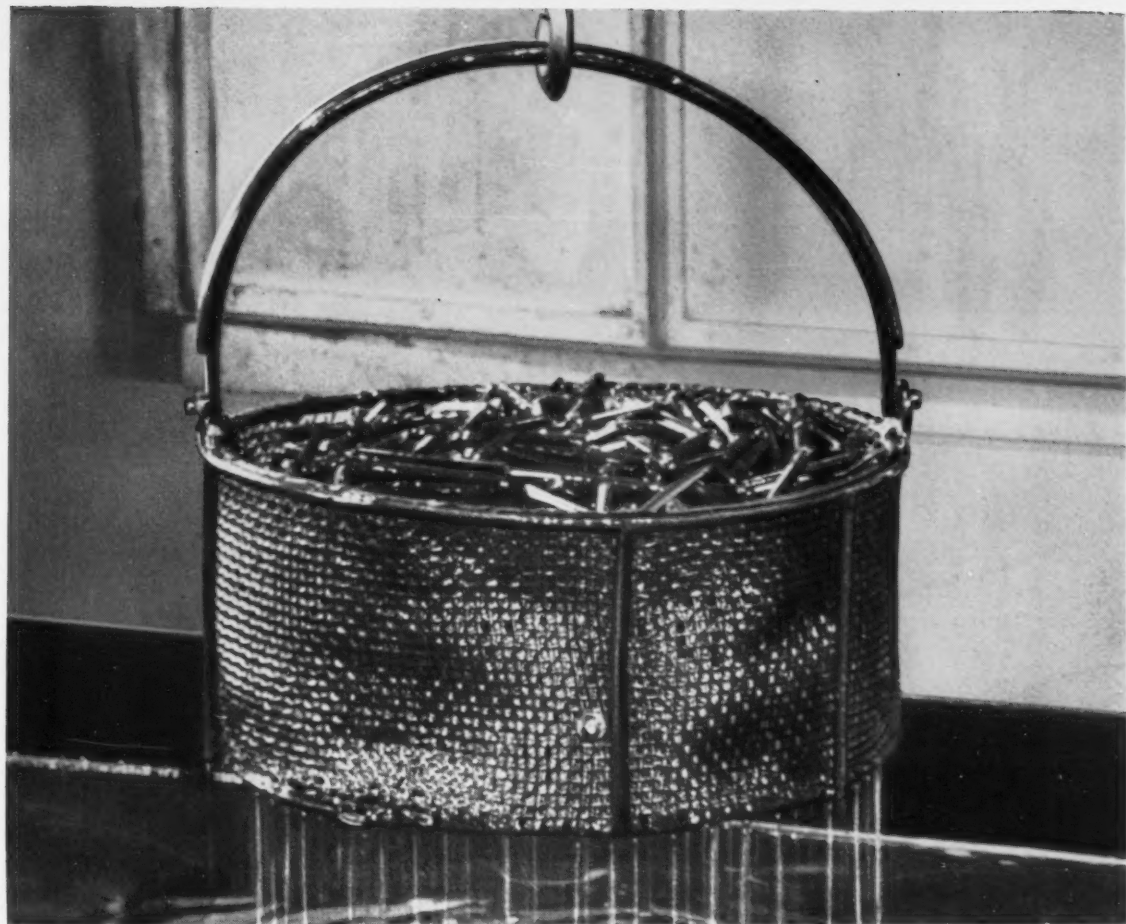
### What Arbitrator Charles H. Livengood, Jr. Ruled:

"The Company's position seems to be that if Bradley was well enough to play cards all night, he was well enough to work. But that does not follow. Playing a friendly card game in a warm, comfortable room, with ample personal conveniences is not the same thing as performing physical labor in a shop. A person who is sick enough to justify missing his work as a mechanic may nevertheless feel like reading or playing cards or similarly passing the time. Here, at worst, the evidence merely suggests that Bradley may have shown poor judgment in going out and sitting up with a severe cold. The Company can hardly undertake to police the way employees care for their health when away from the shop. In any event, there is nothing to show that Bradley's absence was prolonged by what he did.

"On all the evidence, it must be found that Bradley had a reasonable excuse for his failure to report for work, and that the Company acted unreasonably in substituting the non-professional opinion of its superintendent for the judgment of a doctor as to Bradley's illness.

"There is another reason why this grievance must be upheld. According to Bradley's termination notice he was discharged on Monday. This is corroborated by the testimony of the shop committee chairman, who says the superintendent told the committee on Monday that Bradley had been fired. Moreover, the superintendent who was responsible for the decision to fire Bradley, was admittedly out of town on Tuesday when Bradley reported and submitted his doctor's certificate. It thus clearly appears that the decision to discharge Bradley was made before the Company even knew that Bradley had a doctor's certificate and without giving any consideration either to the certificate or to what Bradley might have to say for himself. This was not a proper exercise of the management prerogatives recognized in the contract. When management acts without giving full consideration to material facts which might reasonably have affected its decision, there is an abuse of discretion."

(Continued on page 35)



# You Get Minimum Drag-out with Sun Quenching Oil Light

When you reduce oil consumption by lowering drag-out, you cut a major cost in operating a quenching system. Sun Quenching Oil Light thins out when heated, drains off parts faster and more completely. And Sun Quenching Oil Light, because of its natural detergency, prevents the formation of sludge

deposits, aids in removing any deposits that have accumulated. And under normal operating conditions it need never be replaced. Sun's booklet "Sun Quenching Oils" tells about this low-cost oil. For a copy, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. MR-3.

**INDUSTRIAL PRODUCTS DEPARTMENT**  
**SUN OIL COMPANY**



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*Made by the producers of famous Blue Sunoco Gasoline and Dynalube Motor Oils*

*For further information circle No. 4*

# THE APPRENTICE CORNER

**Editor's Note:** The following column appears regularly in METAL TREATING and is designed to aid young men who have only recently started in the heat treating industry. If you would like to see specific subjects discussed, or if you have any questions, let us know what they are.

## Name That Steel!

Every heat treater realizes that before he can do a proper job on any piece of steel, he must know its *composition*.

Fortunately, this doesn't mean that a detailed written analysis must accompany each job. Far from it. In the case of a tool steel, the manufacturer's brand (example: Prime Steel Company's "MONODI") will suffice. A heat treating plant usually has on file the analysis of all steels.

Quite a few production steels, also, carry brand names. But the majority of these will be found in steel classification lists, where they are identified by a prefix (such as SAE, AISI, or ASTM), followed by a number which to the initiated tells the whole story.

Would you like to know how you, too, can become expert at grasping the meaning of those numbers? All right, let us start with a steel known as SAE-1020. We need only explain that the letters SAE are the initials of the Society of Automotive Engineers, who set the composition standards. Next, look at the number—1020. The first half (10) shows the *class* into which this steel falls. That is known as the "1000" series, which means it is an otherwise unalloyed, straight carbon, steel. The last two figures (20) tell the approximate amount of carbon, in this case about two-tenths of 1%, so it is spoken of as a "straight" (unalloyed) .20 carbon steel.

There are, of course, lots of other classes. All the others contain one or more alloys and are grouped and numbered according to their alloys. SAE-2320 is just like SAE-1020 except that nickel (only) has been added. So throughout the 2300 series, regardless of amounts of carbon, all steels in this class are alloyed with nickel. Thus, a 2350 steel contains .50 carbon, its alloy, of course, being nickel.

When you run across a steel called "4140" you

now will know at a glance that its carbon is about .40. But, for the combination of alloys in the 4100 series, consult a steel classification table.

The American Iron and Steel Institute issues its own classification lists, as does also the American Society for Testing Materials.

If you have never looked over any of these tables, by all means get one. You will find it interesting and enlightening. Valuable, too, since the alloying of steel, as well as the carbon it contains, has much to do with successful heat treatment.

You might, in fact, do well to follow up by asking your foreman to explain how a slight change in steel ingredients often solves difficult problems, and helps to produce a better product.

Not many years back, there were just three kinds of steel:

1. Mild, or machine steel, which requires the addition of carbon before it will harden, even on the surface.
2. High carbon steels, which are hardenable.
3. High speed steels, to cut the above.

The equipment in those days was simple and low in cost; the methods employed were few. But how incredibly complex this situation has become!

Those three steels have "sprouted innumerable branches" and now are of endless variety. There are hundreds of ways to treat them, also, many special costly devices. But still there is a *one best way* to do each job.

You want the best, always, because no matter how carefully the steel may be alloyed and refined, forged, rolled, and annealed, or how much time, thought and money you put into producing a tool or part, the end result is going to depend very largely upon how it is heat treated.

What good, for instance, is a die that isn't properly hardened?

You must, of course, be aware of the ever widening gap between the men who make mechanical items, and those who must heat treat them. Articles made in one department are hardened in another; often they are sent out to a commercial heat treating plant. Now, untold trouble and grief can arise if between the time a piece of steel is cut off the bar in the storeroom and the time when the heat treater gets it, all track is lost as to the *kind* of steel it is.

A similar difficulty arises when a multiplicity of parts are made from a mixture of steels.

The thing you should remember always is that a heat treater is in no position to accurately identify the kind of steel handed him unless it is marked. Its identity is not disclosed by its appearance. Even when touching each piece to a grinding wheel and observing the sparks, such "spark-tests" are not dependable. There is no substitute for the proper identification of steels. ■ ■ ■



# Cut metal-treating costs 55% with Armour Ammonia !

This cost comparison chart illustrates how you can make this great saving by switching to pure, dry Armour Ammonia, as a source of hydrogen !

	<u>HYDROGEN</u>	<u>ARMOUR AMMONIA</u>	<u>REMARKS</u>
Delivered base price . . . . .	\$2.00 per cyl. . . . .	\$18.50 per cyl. . . . .	
Volume per cylinder . . . . .	200 cu. ft. . . . .	4500 cu. ft. . . . .	After dissociation
Equivalent number of cyls. . . . .	23 . . . . .	1 . . . . .	
Handling labor (5¢/cyl.) . . . . .	\$1.15 . . . . .	\$.05 . . . . .	
Storage cost (4¢/cyl.) . . . . .	.92 . . . . .	.04 . . . . .	
Handling labor/100 cu. ft. . . . .	.025 . . . . .	.001 . . . . .	
Storage cost/100 cu. ft. . . . .	.020 . . . . .	.001 . . . . .	
Cost of product/100 cu. ft. . . . .	1.00 . . . . .	.410 . . . . .	
Cost of equipment/100 cu. ft. . . . .	— . . . . .	.125* . . . . .	Amortized in 3 years
Cost of electric power/100 cu. ft. . . . .	— . . . . .	.060 . . . . .	
Total cost/100 cu. ft. . . . .	\$1.045 . . . . .	\$5.97 . . . . .	
Savings in operation/100 cu. ft. . . . .		.448 . . . . .	
Percentage savings in operation cost . . . 44%			
and after equipment is amortized, savings are . . 55%†			

\*This figure arrived at by the following assumption: 500 cu. ft.-per hour dissociator costs approximately \$4500 installed. Assume equipment to be completely amortized in 3 years, then amortized cost of equipment equals \$.125 per 100 cu. ft.

DATA COURTESY THOMAS GAS CONTRACTORS, WESTFIELD, N. J.

## Let Armour Help Solve Your Metal Treating Problems

Manufacturers get more than ammonia when they specify Armour. Since 1947 Armour has sponsored a fellowship at a leading technological university for the study of metal treating processes using ammonia. The results of this research are available to you. Furthermore, the men of the Armour Technical Service Department are equipped to handle and answer any problems arising with ammonia installations for metal treating. Write today for free copies of the booklets offered at right. If your problems are unusual or pressing, write, giving full details.

† Additional savings are possible when you order tank truck quantities—service available in most areas.



## CLIP AND MAIL THIS TODAY !

Please send me free copies of the booklets which I have checked:

- ☐ "Ammonia Cylinder Installations for Metal Treating"
- ☐ "Effective Use of Dissociated Ammonia"
- ☐ "Case Hardening of Steel by Nitriding"
- ☐ "A Survey of Industrial Carbonitriding Practice"
- ☐ "Investigation into the Carbonitriding of Plain Carbon Steel"
- ☐ "The Carbonitriding of Alloy Steels"
- ☐ Tank truck service information

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**ARMOUR**

*Ammonia Division*

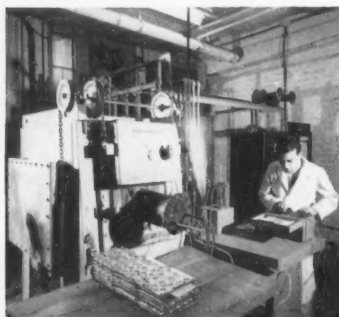
Armour and Company • 1355 W. 31st Street • Chicago 9, Ill.

For further information circle No. 21



### Specialized Treatment

Magnetic amplifier toroidal cores are heat treated in the Westinghouse box-type furnace shown here. An average load for the furnace varies between 5 and 10 pounds which may be as high as 600 cores. Annealed in a hydrogen atmosphere, the cores are held at 2190° F. for a cycle from 2 to 24 hours depending on the core material and the core magnetic properties desired.



The furnace is equipped with electric heating elements and has a maximum temperature rating of 2400° F. While temperatures in the large furnace chamber are recorded automatically, an operator periodically checks the temperature within the annealing tube to make certain that the critical core annealing temperature is constant.

*For further information circle No. 8*

### Finishing Abrasive

A new abrasive product for barrel finishing has been announced by The Exolon Company, Tonowanda, New York.



The material is made from selected grades of aluminum oxide and processed to remove all sharp edges which might scratch the work. Sizes range from two inches down.

The successful application of the abrasive is due to its toughness and its hard abrasive surface reported the manufacturer. It is made in an electric arc furnace from bauxite which is melted and forms hard aluminum oxide crystals with facets in every conceivable direction.

*For further information circle No. 9*

### Government-Owned Inventions

A new Government publication entitled "*Metal Processes and Apparatus, Machinery, and Transportation Equipment*," containing 657 abstracts or brief descriptions of Government-owned inventions applicable in these fields, was recently announced.

These inventions are classified as to industrial use under the following groups to help readers quickly locate items of particular interest: ferrous metal processes and apparatus; nonferrous metal processes and apparatus; electro-metallurgical processes and apparatus; powder metallurgical processes and apparatus; coating processes and apparatus; agricultural equipment; construction, mining, and oil field equipment; conveyors and other material handling equipment; food-products equipment; heating and plumbing equipment; metal-working equipment; pumping equipment; refrigeration and air-conditioning equipment; textile equipment; miscellaneous machinery and equipment; engines; aircraft and related equipment; motor vehicles and related

equipment; and ships and related equipment.

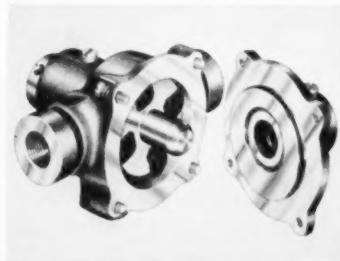
This new publication includes the title and number of the patent, name of the inventor, the Government agency administering the patent, and a list of the addresses of the field offices of the U. S. Department of Commerce and of the Small Business Administration which may be consulted concerning the availability and use of the inventions.

This new book (Order No. PB111467) may be purchased at \$2.00 per copy from the Office of Technical Services, U. S. Department of Commerce (Room 6227), Washington 25, D. C.

### Variable Cavity Pump

Maintaining a constant volume of flow despite fluctuations in city water pressure is the function of a new Variable Cavity pump built by Hypro Engineering, Inc., Minneapolis, Minn.

When the pressure in the pump reaches a predetermined point, a spring loaded end plate moves outward, increasing the length of the pump cavity and enlarging the clearances between the ends of the rotor and the end plate.



Increased clearances in the pump permit the liquid to recirculate, reducing the pump's maximum pressure.

*(Continued on page 24)*



**spot the champ**

*... and with high speed steels  
the champion's always **REX***

Compare the freckles and you'll pick the champ. And it's easy to spot the champ in high speed steels, too, for Crucible REX® has been the *standard of comparison* for over half a century.

Prove the reasons for REX's superiority in your own shop. You'll like its hardenability . . . response to heat treatment . . . fine tool performance. Like thousands of other users, you'll agree you *can't find a high speed steel to outperform REX.*

Ask for REX, a *prescription-made* Crucible product, at Crucible warehouses or leading distributors from coast to coast. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

Visit us at Booth 350  
Western Metal Show  
Los Angeles—Mar. 28-Apr. 1

**CRUCIBLE**

first name in special purpose steels

**Crucible Steel Company of America**

*For further information circle No. 10*

MARCH-APRIL 1955

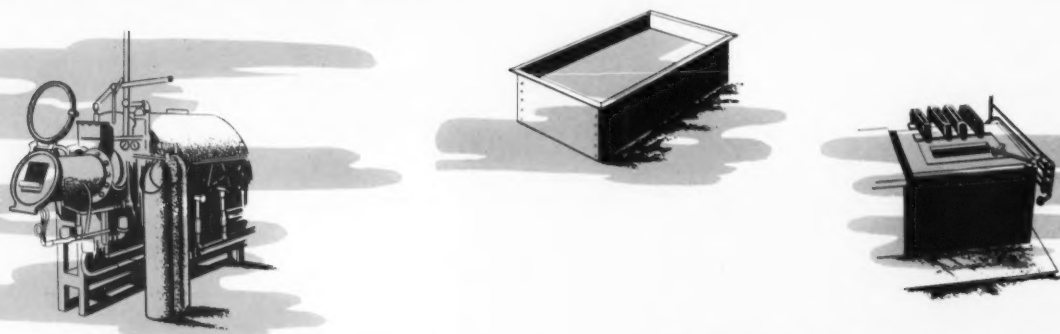
21

*it takes more than these*



*...to build a bridge*

*it takes more than these*



*..to heat treat metals*

**Both Must Have The Vital Ingredients — Skill and Experience**

It is a sad fact that many skilled production men and managers have been, in recent years, badly misled into believing that given a furnace — a quench tank — a salt bath, and a corner of floor space — they can promptly and easily fulfill their heat treating requirements. Aggressive and misleading selling by some furnace and equipment manufacturers (fortunately only a small minority) has encouraged this misconception that equipment and materials alone are the essential factors in heat treating operations.

The cold fact is, that without the proper combination of human operational skill and technical knowledge developed over **years** of practical experience, even the best, most mechanical, most modern heat treating equipment becomes a potent menace to your product and your profit margin.

Careful evaluation of **all** the factors involved in any heat treating operation — large or small — always reveals that **TECHNICAL SKILL BORN OF EXPERIENCE** tops the list.

Make it head **your** list when you are analyzing the pros and cons of the question "Shall we do our own heat treating?" Write for a useful folder — "Facts and Figures on Heat Treating Costs".

*If you are faced with heat treating problems or the need for heat treating services write*

**METAL T**

271 NO



For the BEST in Heat Treating Consult these Companies:

## There's a Heat Treating Specialist Near Your Plant!

### ALABAMA

Southern Metal Treating Co., Inc.  
3131 10th Ave., North, Birmingham 4

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Hollywood Heat Treating Co.  
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Lindberg Steel Treating Co.  
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Malloy Heat Treating Co.  
11648 So. Atlantic, Lynwood  
Cook Induction Heating Co.  
4925 East Slauson Ave., Maywood  
Dexter Metal Treating Co.  
1026—77th Ave., Oakland 21  
Industrial Steel Treating Co.  
1549—32nd St., Oakland 8  
Valley Metal Treating Co.  
355 So. East End Ave., Pomona

### COLORADO

Metal Treating & Research Co.  
4110 Fox St., Denver 16

### CONNECTICUT

Commercial Metal Treating, Inc.  
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Stanley P. Rockwell Co.  
296 Homestead Ave., Hartford 5

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Accurate Steel Treating Co.  
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Chicago Steel Treating Co.  
333 North California, Chicago  
Dura-Hard Steel Treating Co.  
2333 West Deming Place, Chicago 47  
Pearson Industrial Steel Treating  
5757 Ogden Ave., Chicago 50  
Perfection Tool & Metal Heat Treating Co.  
1756 West Hubbard St., Chicago 22  
Fred A. Snow Co.  
1942 West Kenzie St., Chicago 22  
American Steel Treating Co.  
P. O. Box 225, Crystal Lake  
Eklund Metal Treating, Inc.  
721 Beacon St., Loves Park  
Lindberg Steel Treating Co.  
1975 No. Ruby St., Melrose Park  
O. T. Muehlemaier Heat Treating Co.  
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### MARYLAND

Maryland Tool Company  
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Porter Forge & Furnace, Inc.  
74 Foley St., Somerville 43  
Greenman Steel Treating Co.  
284 Grove St., Worcester 5

### MICHIGAN

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Anderson Steel Treating Co.  
1337 Maple St., Detroit 7  
Bosworth Steel Treating Co.  
18174 West Chicago Blvd., Detroit 28  
Commercial Steel Treating Corp.  
6100 Tireman Ave., Detroit 4  
Commonwealth Industries, Inc.  
5922 Commonwealth Ave., Detroit 3  
Michigan Steel Processing Co.  
3120 Denton, Detroit 11  
Standard Steel Treating Co.  
3468 Lovett Avenue, Detroit 10  
Vincent Steel Process Co.  
2424 Bellevue Ave., Detroit 7  
State Heat Treat, Inc.  
520 32nd Street, S. E., Grand Rapids 3  
American Metal Processing Co.  
12000 East Nine Mile Road, Van Dyke

### MINNESOTA

Metallurgical, Inc.  
900 East Hennepin, Minneapolis 14

### MISSOURI

Metallurgical, Inc.  
1915 Tracy Ave., Kansas City 8  
Lindberg Steel Treating Co.  
650 East Taylor Ave., St. Louis 15  
Paulo Products Co.  
5711 West Park Ave., St. Louis 10

### NEW JERSEY

Ace Metal Treating Corp.  
611 Grove St., Elizabeth  
American Metal Treatment Co.  
Highway 25 and LaFayette St., Elizabeth  
Benedict-Miller, Inc.  
Marin Ave. and Orient Way, Lyndhurst  
Bennett Heat Treating Co., Inc.  
246 Raymond Boulevard, Newark 5  
L-R Heat Treating Co.  
107 Vesey St., Newark 5  
Temperature Processing Inc.  
228 River Road, North Arlington  
Metro Heat Treat Corp.  
9 Victoria Terrace, Ridgefield

### NEW YORK

Fred Heinzelman & Sons  
138 Spring St., New York 12  
Alfred Heller Heat Treating Co., Inc.  
391 Pearl St., New York 38  
Metro Heat Treat Corp.  
466 Broome St., New York 13  
Lindberg Steel Treating Co.  
620 Buffalo Road, Rochester 11  
Rochester Steel Treating Works  
962 Main Street, E., Rochester 5  
Syracuse Heat Treating Corp.  
1223 Burnet Ave., Syracuse 3

### OHIO

Queen City Steel Treating Co.  
2980 Spring Grove Ave., Cincinnati 25  
Ferrotherm Co.  
1861 E. 65th St., Cleveland 3  
Lakeside Steel Improvement Co.  
5418 Lakeside Ave., Cleveland 14  
George H. Porter Steel Treating Co.  
1273 East 55th Street, Cleveland 3  
Reliable Metallurgical Service, Inc.  
3827 Lakeside Ave., Cleveland 14  
Winton Heat Treating Co.  
20003 West Lake Road, Cleveland 16  
Dayton Forging & Heat Treating Co.  
2323 East First St., Dayton 3  
Ohio Heat Treating Co.  
1100 East Third St., Dayton 2

### PENNSYLVANIA

Robert Wooler  
Limekiln Pike, Dresher  
J. W. Rex Co.  
834 West Third St., Lansdale  
Drever Company  
220 West Cambria St., Philadelphia 33  
Lorenz & Son  
1351 N. Front St., Philadelphia 22  
Metlab Company  
1000 East Mermaid Lane, Philadelphia 18  
Wiedemann Machine Co.  
4272 Wissahickon Ave., Philadelphia 32  
Ferrotherm Company  
4911 Butler St., Pittsburgh  
Pittsburgh Commercial Heat Treating Co.  
49th St. and A.V.R.R., Pittsburgh 1

### TEXAS

Dominy Heat Treating Corp.  
P. O. Box 5054  
Dallas, Texas  
Superior Heat Treating Co., Inc.  
P. O. Box 1686  
Fort Worth 1, Texas  
Cook Heat Treating Co., of Texas  
6233 Navigation Boulevard, Houston 11

### WISCONSIN

Allied Metal Treating Corp.  
Highway K & 60th Street, Kenosha  
Hushek Metal Processing Co.  
1536-40 West Pierce Street, Milwaukee 4  
Metal Treating, Inc.  
720 South 16th St., Milwaukee 4  
Supreme Metal Treating Co.  
4440 West Mitchell St., Milwaukee 14  
Thurner Heat Treating Co.  
809 West National Ave., Milwaukee 4  
Wesley Heat Treating Co.  
1333 West Pierce Street, Milwaukee 4  
Wesley Steel Treating Co.  
1301-1403 West Pierce St., Milwaukee  
Harris Metals Treating Co.  
1745 Taylor Ave., Racine  
Spindler Metal Processing Co.  
2338 Mead Street, Racine  
Wesley Metal Treating Co.  
2320 Mead Street, Racine

# HEAT TREATING INSTITUTE

1 AVENUE

NEW ROCHELLE, N. Y.

or consult the MTI members listed above

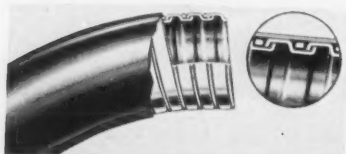


## News to Heat Treaters(Cont.)

### Flexible Waterproof Conduit

A new flexible-metal, electrical wiring conduit which is fully enclosed in a tough, waterproof, synthetic cover is being marketed by the Universal Metal Hose Co., of Chicago.

This new conduit provides



complete protection against moisture, dirt, oil, fumes, and chemicals. It is reported to be suited for applications requiring flexibility for connections in tight places, for connecting wires on machinery constantly operating in excessive oil or moisture, and for applications of extreme vibration. It is available in 3/8" to 2" conduit sizes.

*For further information circle No. 12*

### Annealing Titanium

Removing hydrogen from titanium through high vacuum an-

nealing, recently utilized by the aircraft industry and now used by them in making jet plane parts, is a service being offered by Kinetics Corp., Boston 15, Massachusetts.

The company was formed solely for the purpose of supplying facilities for high vacuum annealing of titanium, zirconium, or other active metals. High vacuum furnaces specially designed and manufactured by High Vacuum Equipment Corp., Hingham, Massachusetts, are being used. The retorts of these furnaces have a hot-zone which is 26 1/2" I.D. by 27" long, and will accommodate coils, strips, wire, formed pieces, castings and billets.

According to tests, the tensile strength of a good percentage of titanium can run as low as 60,000 psi when small amounts of hydrogen are present in the metal, but when this hydrogen is removed by heating under vacuum, the tensile strength can be increased up to 160,000 psi.

*For further information circle No. 14*

## HEAT & CORROSION RESISTANT

### Castings & Fabrications

#### FURNACE BASKET

This pit type furnace basket, employing cast bottom grids and trunnions with sheet sides, is available in many sizes and designs. The cast bottom grids provide maximum load carrying ability, while the sheet sides provide maximum heat transfer and maximum work capacity with minimum weight. Available with and without trunnions and lift rods. Also available with stacking feature and drop bottom arrangement. Let our engineering staff help you solve your heat resisting alloy problems.



### GENERAL ALLOYS COMPANY

403 WEST FIRST STREET • BOSTON 27, MASSACHUSETTS

*For further information circle No. 13*

### Automatic Chart Identifier

A new device that automatically prints a number, date or time on Brown strip chart and similar recorder charts at any instant when a voltage is applied to the device during process, test and control work has recently been developed by Royson Engineering, Hatboro, Pa. The unit, called the "Identichart," makes it easy for users to iden-



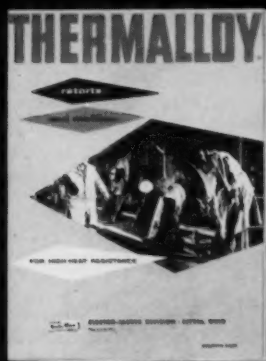
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METAL TREATING

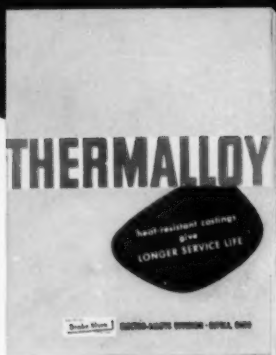
*Here's help in Ordering*  
**THERMALLOY\***  
 heat-resistant castings



Centrifugal  
Castings Bulletin



Muffles & Retorts  
Bulletin T-239



General Thermalloy  
Catalog T-225



Conveyor Belt  
Bulletin T-241



Heat Treat Trays & Fixtures  
Bulletin T-227

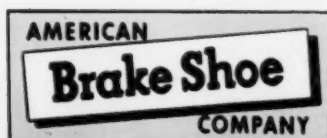


Heat Treat Pots  
Bulletin T-234

Wherever high heat and special atmospheres are problems in heat-treating or processing equipment, Thermalloy heat-resistant castings can help to minimize expensive repairs, high maintenance costs, sudden breakdowns.

To help you in ordering Thermalloy heat-

resistant castings for use in many different types of equipment, you will find assistance in these bulletins. To obtain the bulletins pertaining to your problem, call your nearest Electro-Alloys representative or write Electro-Alloys Division, 6003 Taylor St., Elyria, Ohio.



**ELECTRO-ALLOYS DIVISION**  
 Elyria, Ohio

\*Reg. U. S. Pat. Off.

For further information circle No. 15



# ABSTRACTS

### The Use of Peroxygen Compounds in Treating Metal Surfaces

By P. H. Margulies

(*The Iron Age*, January 27, 1955)

Treatment of metal surfaces with oxidizing agents can be roughly grouped into four types according to the desired result. One type produces an oxide film on the metal surface proper. A second type removes undesirable components from the metal surface. Somewhat overlapping this is a third type which dissolves and removes metal from the surface. As a fourth type of treatment, some oxidizing agents also keep constituents of certain treating solutions in the proper state of oxidation.

Many surface treatments applied to metals involve the use of solutions containing oxidizing agents—mainly chromates or nitrates and the corresponding acids. In many other cases, use of peroxygen compounds offers advantages or sometimes is a necessity. These include hydrogen peroxide, compounds forming hydrogen peroxide in solution, persulphates and peracids.

Peroxygen compounds are useful in all four types of treatments. Staining and passivating procedures are examples for the first type of treatment. The staining treatment is generally carried out by immersing the pieces in a hot, strongly-alkaline solution containing an oxidizing agent. Sodium hydroxide is the alkali commonly used, and the recommended oxidizing agents are sodium peroxide or its equivalent, hydrogen peroxide.

A very durable black finish for zinc and cadmium consists of a strongly adherent film of fine-grained copper oxide. Here, too, treating the article with a hydrogen peroxide solution increases both the blackness and adherence of the finish. This finish can also be applied to other base metals after zinc or cadmium plating.

Another example where peroxides improve finishes occurs in a method of improving the electrical characteristics of cuprous oxide surfaces in rectifiers, by removing surface components by oxidation in a solution of equal parts of ammonium hydroxide and hydrogen peroxide. Also, a solution useful for cleaning tin, zinc and aluminum surfaces without etching or discoloring is made with peroxides.

The "bright-dip" processes are related to etching and stripping procedures. Here again, per-

oxygen compounds are useful because they brighten a metal surface by chemically removing high spots and other surface irregularities and help to remove surface contaminants.

An example of the fourth type of treatment in which oxidizing agents keep the constituents of certain treating solutions in the proper state of oxidation is the use of hydrogen peroxide to control the chemical composition of solutions used in phosphatizing iron and steel. Also, hydrogen peroxide in acid solution is an efficient brightening agent for zinc and cadmium surfaces, and at the same time they are made more stain-resistant by such treatment.

Peroxide solutions are also very important in the treating of steel and brass. A typical bright-dip treatment for steel removes rust in such a way that the exposed metal surface is left shiny and light. This eliminates the need for mechanical finishing in order to improve surface appearance. It is an acid pickling process involving sulphuric, phosphoric and other acids. The addition of a peroxygen compound to the pickling acid accounts for the satisfactory appearance of the surface directly after pickling. Chemical brightening of brass is usually done by chromate-sulphuric acid pickling. Practically the same effects can be achieved by using an acetic acid solution of hydrogen peroxide, and treatment with an acid solution of a persulphate gives an etched appearance to a brass surface.

■ ■ ■





## News to Heat Treaters(Cont.)

tify individual sections of recording charts in relation to particular conditions taking place at a remote point. It is supplied in kit form so that the user can easily install the unit. The kit consists of a strip of rubber for the chart platten, mounting screws, plexiglass window to replace the original one in the door, plastic transparent cover for the device itself and instructions for installing. Wires on the unit go to the power supply and switch which is connected to the process.

For further information circle No. 16

## Abrasive Blasting

Airless abrasive blasting has proved to be successful for job metal cleaning at Harris Metals Treating Company, Racine, Wisconsin. To handle a very great



Courtesy American Wheelabrator & Equipment Corp.

range of work, the shop employs two types of machines. One uses the airless blasting principle in conjunction with tumbling. This is shown in the accompanying photo. It has a five-cubic-foot load capacity, and takes care of all the smaller work that is comparatively compact and can withstand tumbling action. The other is a table-type unit, for handling "fragile" work like gears which can't be tumbled. It also handles long objects, such as shafts that would not fit the other machine.

Both units were built by American Wheelabrator & Equipment Corporation, Mishawaka, Indiana, and do their cleaning by

means of metallic abrasive hurled centrifugally upon the work. This is done by a rapidly rotating wheel inside each cabinet.

The majority of the cleaning work consists of normalized forgings that have not only heat treatment scale on them but forging scale as well. These heavily scaled parts are blast cleaned in an average of eight minutes per load.

For further information circle No. 17

### MANUFACTURER'S REPRESENTATIVES WANTED

Now selling heat treating departments and commercial plants for electronic induction heating generators. Complete range types and sizes—leader in the field. Established accounts nationally. Liberal trade-in, rental plan provides substantial volume. High potential in growing industry. Expansion program, territory revision make several excellent openings available for experienced representatives. Liberal Commission.

Box MR, Metal Treating, 271 North Ave. New Rochelle, N.Y.

## DEMPSEY FURNACES

GAS, OIL AND ELECTRIC  
BATCH • CONTINUOUS

ATMOSPHERIC-RECIRCULATING-  
PUSHER—ROTARY HEARTH—  
CONVEYOR—RADIANT TUBE—POT  
CAR-BOTTOM—ALUMINUM REVERBS.

"Tailored by Dempsey"



DEMPSEY INDUSTRIAL FURNACE CORP.  
Springfield 1, Mass.

For further information circle No. 18

### WANTED TO LEASE

One 200 kw-440 volt or larger Tocco induction hardening machine. Will use minimum of six months.

Box WL, Metal Treating, 271 North Ave., New Rochelle, N.Y.

# BIG BASKETS!

## OR LITTLE BASKETS

*You name it... Stanwood has it!\**



Big or small, Stanwood engineers have likely designed a basket suitable to your requirements . . . that will more efficiently handle your parts through heat-treating, quenching, pickling or bright dipping. Stanwood Baskets are noted for proper design, proper materials . . . longer service. Meet your needs from our hundreds of designs . . .

\*OR WE'LL MAKE IT TO YOUR "SPECS!"  
With any heat-treating problem . . . to make good . . . try Stanwood!

RETOURC

BASKETS

TRAYS

CARBURIZING BOXES

FILTERS



**Stanwood**  
4825 W. CORTLAND ST.



**Corporation**  
CHICAGO 39, ILLINOIS

For further information circle No. 19

# ROLOCK

FABRICATED ALLOYS

HEAT AND CORROSION RESISTANT



## FEATURES OF THE ROLOCK NEU-POT

WROUGHT ALLOY, strong, dense, uniform . . . gives thinner sections more rapid heat transfer, less hot spots, faster heat recovery.

ALLOY WELDS X-ray inspected . . . free from slag, air pockets, cracks. No premature failures due to these causes.

HEADS of fabricated pots stocked in standard diameter . . . wide range of depths quickly made without special patterns, tools.

## HERE'S TERRIFIC SERVICE . . . 8000 Hours . . SO FAR . . with Neutral Salts!

Yes . . . that's really phenomenal cost saving . . . but Rolock customers expect and get more than normal use from our fabricated-welded heat treating equipment.

In this instance, it's a fabricated Inconel pot . . . 1/4" plate . . . which withstands a 1550° F. operating temperature for 16 hours per day . . . stands idle for 8 hours . . . then over Sunday at about 1300° F. So far its life totals 18 months. This is probably a record, but many other Rolock neutral salt pots have served for 12, 14, 15 and 16 months . . . up to 5000 hours. Naturally, higher temperatures reduce service life.

If you require neutral salt pots of this type (any size), you will want specifications and quotations that will clearly show cost-cutting. Write for complete details of this up-to-the-minute equipment . . . or any other type of fabricated heat and corrosion resistant alloys.

SALES AND SERVICE REPRESENTATIVES FROM COAST TO COAST  
ROLOCK INC., 1232 KINGS HIGHWAY, FAIRFIELD, CONN.

**JOB-ENGINEERED** for better work  
Easier Operation, Lower Cost

1RL55

For further information circle No. 20

## Practical Applications of Furnace Atmosphere

(Continued from page 6)

point of 42° F., or at a number of other possible combinations. If the stamping is 0.020" thick, about 45 to 60 minutes at heat will be sufficient at 1600° F. The stampings are quenched directly from the furnace and are ready for tempering to the desired spring properties.

### Deep Case Carburizing

Accurate control of the carbon content of the carburized case is possible through use of the equilibrium curves. A diffusion period is used at the end of the carburizing cycle in order to diffuse the excess carbon in the case inward to the core and outward to the atmosphere. For example, if a 0.050" case was specified with 0.80% carbon, a 25° F. dew point temperature would be used (see 1700° F. curve on Fig. 7). About 6 hours, depending on furnace conditions, would be necessary. For the first 4 hours of carburizing, approximately 10% of natural gas would be added to the atmosphere to increase the carbon potential to the maximum. During the last 2 hours of the cycle, the enriching gas would be shut off and diffusion would equalize the carbon content of the case as mentioned above.

## News to Heat Treaters(Cont.)

### Molecular Sieves

Linde Air Products Co., a Division of Union Carbide and Carbon Corp., New York, N.Y., recently announced the availability of Linde Molecular Sieves for selective adsorption of liquids and gasses. The sieves are synthetic zeolites composed of soda, lime, alumina and silica, and are quite similar to many natural clays and feldspars. These unique materials are capable of unusual selectivity since they will adsorb materials on the basis of molecule size. Silica gel, alumina and activated carbon, now widely used

METAL TREATING



for adsorption, tend to adsorb higher boiling point components of a mixture in preference to lower boiling point parts. Such is not the case with Molecular Sieves and thus they can overcome the limitations of these other materials.

Two types of sieves are available, 4A and 5A, which have different molecular pore openings. Both types will, for example, adsorb water, carbon dioxide, carbon monoxide, ammonia and methane, while propane and materials of similar molecular size will be adsorbed on the 5A but passed by the 4A.

The sieves, shown here in powder form, will adsorb water at temperatures as high as 250°F. and very low dew points can be achieved, down to -100°F. Liquid water does not damage the material.

For further information circle No. 21

### Immersion Heating

Recently introduced heat transfer units have solved heating problems for one company in connection with stainless steel



pickling and passivating according to the manufacturers' report. The units, known as "Platecoils," consist of two embossed plates of metal welded together to provide channels for passage of heating or cooling media. They are made by Tranter Manufacturing, Inc., Lansing, Michigan. For heating acid-contaminated rinse and caustic solution tanks, this company found that bubbling steam through the solution was unsatisfactory and normal steam coils were too bulky and expensive. With stainless steel "Platecoils," space is conserved, safety is im-

proved, control is maintained and cost is low, the company reports. Steam, under 100 to 110 psi, is the heating medium for bringing solution temperature up to 190 degrees Fahrenheit.

For further information circle No. 22

### Burner for Tube Use

Hauck Manufacturing Company, Brooklyn, N.Y. has introduced the series 630-P combination burners for radiant and immersion tube firing. The flame length is adjustable to fit tubes

(Continued on page 31)



## DESIGNED for PLUS performance

Typical of our production furnaces designed for special requirements is this DFC SHAKER HEARTH FURNACE for small pieces. It offers over-all *simplicity, extreme versatility, and rugged, trouble-free service.*

- atmospheric controlled heat-treating
- assured uniformity of results
- greater range of piece sizes
- wide range of speed adjustments

On standard types or specials—put your furnace problems up to DFC. Write for data or see nearest dealer.

#### CHICAGO

Abbot Corporation  
808 West Erie St.

#### DETROIT

Koehler & Morgan Co.  
12099 Woodbine St.

#### HOUSTON

McArdle Equipment Co.  
5724 Navigation Blvd.

#### INDIANAPOLIS

Lay Instrument Co.  
2323 N. Sheridan Ave.

#### KANSAS CITY, MO.

Central States Equip. Co.  
18 West 43rd St.

#### LOS ANGELES

Automatic Inst. Service Co.  
7807 So. Compton Ave.

#### MILWAUKEE

Wis. Inst. & Control Co.  
1404 W. Fond du Lac Ave.

#### MINNEAPOLIS

American Steel Prod. Co.  
2828 Lyndale Ave. South

#### OAKLAND

Russo Foundry Equip. Co.  
3882 Fairway Ave.

#### OMAHA

Fuchs Mach. & Supply Co.  
2401 No. 11th St.

#### PITTSBURGH

John E. Finger Co.  
1123 La Clair Ave.

#### ROCHESTER, N. Y.

Marin-Mercier Co.  
36 Winthrop St.

#### ST. LOUIS

Shen-Brownell Co.  
3903 Olive Street



For further information circle No. 23

# INSTITUTE NEWS



## Spring Meeting Program

As this issue goes to press, final arrangements are being made for the 1955 Spring Meeting in Los Angeles, California. The three-day program for May 9th, 10th and 11th is designed for both technical and recreational interest to the members attending.

Headquarters for the meeting will be The Ambassador but the program also calls for a number of outdoor activities. Among these is a visit to the renowned Knott's Berry Farm which includes the famous "Ghost Town" shown here. At this time the program outline is as follows:

### Monday, May 9th

*A.M.*—Get-together breakfast—Business Meeting, presentation of two papers. Luncheon at The Ambassador.

*P.M.*—Bus trip through points

of interest and trip to Knott's Berry Farm for late afternoon with dinner at the farm.

### Tuesday, May 10th

*A.M.*—Tour of major aircraft plant, luncheon and tour of McCullough Motors.

*P.M.*—Visit to movie studios, bus trip tour of movie stars' homes, Hollywood sightseeing.

*Evening*—Dinner at Cocoanut Grove (special Hawaiian Night).

### Wednesday, May 11th

*A.M.*—Business Meeting, presentation of one paper. Luncheon at The Ambassador.

*P.M.*—Open for golf, swimming, shopping, etc.

*Evening*—Barbecue and dancing at W. W. Farrar's home. (Special events for ladies are being arranged by West Coast members' Wives Committee.)

## Mid-West Chapter Elects Officers

Officers for the current year were elected at a recent meeting of the Mid-West Chapter in Chicago. Philip C. Shaner, Seneca Heat Treating Co., Batavia, Ill., was elected chairman of the group. Walter Hamilton, Accurate Steel Treating Co., Chicago, Ill., was elected to serve as treasurer with Kenneth W. Cook, The Fred A. Snow Co., Chicago, Ill., serving as secretary.

## Two New Members Announced

The following companies were recently admitted to membership in the Institute:

Superior Heat Treating Co., Inc.

P. O. Box 1686

Fort Worth 1, Texas

*Representative*—Mr. C. E. Perkins, Vice-President

Dominy Heat Treating Corp.

P. O. Box 5054

Dallas, Texas

*Representative*—Mr. M. B. Dominy, President

## First "Nitrocycle" Licensee

A. M. Cox, President, Pittsburgh Commercial Heat Treating Company, Pittsburgh, Pa., recently announced that the company has been granted a license for the "Nitrocycle" process. This is the method of high-pressure nitriding developed at the Oil Well Supply Division, U. S. Steel Corporation. (The process was described in the March-April, 1954 issue of METAL TREATING.)

This is the first installation to make the process available for commercial use.

(Continued on page 32)



Members will see this "Ghost Town" at Knott's Berry Farm.



## News to Heat Treaters(Cont.)

by means of an adjusting lever.

Quieter operation is reported since the major portion of secondary air is introduced around the outside of the flame retention nozzle. The burner does not require an eductor or eductor blower. The complete assembly includes a tube mounting collar to fit the specified diameter of the radiant tube.



The manufacturer states that either oil or gas can be burned with equally good results. Spark ignition is provided for easy lighting.

*For further information circle No. 26*

## Dry Ice Crusher

The low temperature treatment and shrinking of metals, and the making of frozen mercury dies and patterns is greatly speeded by the crushing of the dry ice into small nodules, according to the manufacturer of the "Supreme" dry ice crusher, Franklin P. Miller & Son, Inc., East Orange, N. J. The crushed dry ice has greater surface area exposed to the parts being chilled and maintains a closer thermal contact resulting in rapid lowering of temperature. This effect can be varied by adjusting the crushed size of the dry ice. There is no problem in separating the dry ice from finished parts after use as the dry ice sublimates to carbon dioxide.

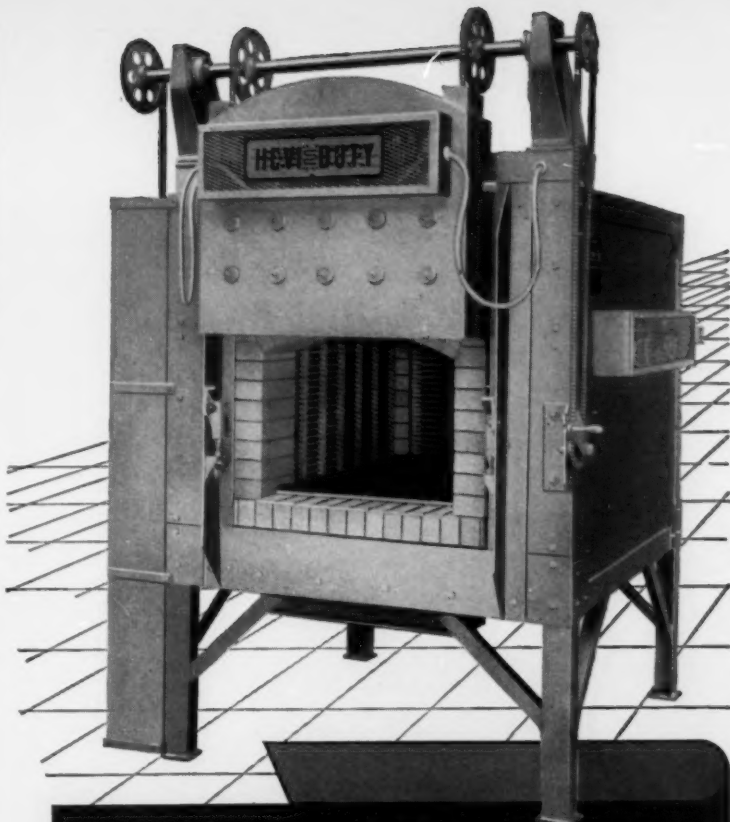
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### LP GAS INSTALLATIONS and ANHYDROUS AMMONIA PLANTS

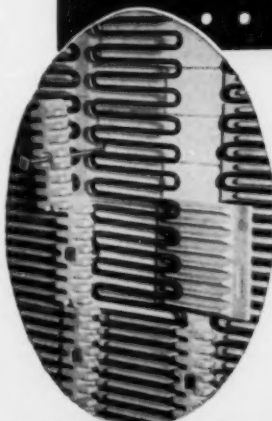
More than 80 Peacock Plants prove . . .

"There's No Substitute For Experience"

**PEACOCK CORPORATION**  
Box 268, Westfield, N. J.  
Westfield 2-6258



# It's the RELIABILITY of HEVI DUTY Furnaces ... that COUNTS



**LONG HEATING ELEMENT LIFE**  
Round rod return bend heating elements are adequately supported by radiant plates of high grade refractory material.

**ADVANCED** design, rugged construction and high quality materials are combined with years of furnace building experience to produce Hevi Duty box furnaces. Round rod heating elements and sturdy radiant plate element supports assure continuous performance under severe operating conditions. Users report that reliability and trouble free service are outstanding advantages of Hevi Duty furnaces.

Write for Hevi Duty Bulletin No. HD441

## HEVI DUTY ELECTRIC COMPANY

HEAT TREATING FURNACES **HEVI DUTY** ELECTRIC EXCLUSIVELY

DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

**MILWAUKEE 1, WISCONSIN**

*For further information circle No. 27*

## INSTITUTE NEWS (cont.)

### MTI-ICS Scholarship Award

Since the last issue in which the winner of the scholarship award was announced, the Institute office has had some very interesting inquiries and comments concerning the program. The winner, Mr. Robert G. Howell, shown here, an employee of An-



derson Steel Treating Company, Detroit, Mich., has completed his application and is now studying the International Correspondence School course in Industrial Metallurgy.

There have been several in-

(Continued on page 40)

MORE PARTS  
PER HOUR  
with

*General*

FLEXIBLE-  
POWER  
STRAIGHTENING  
PRESSES

Let Us  
Prove It!

*General* MFG., CO.  
6437 FARNSWORTH  
DETROIT 11, MICH

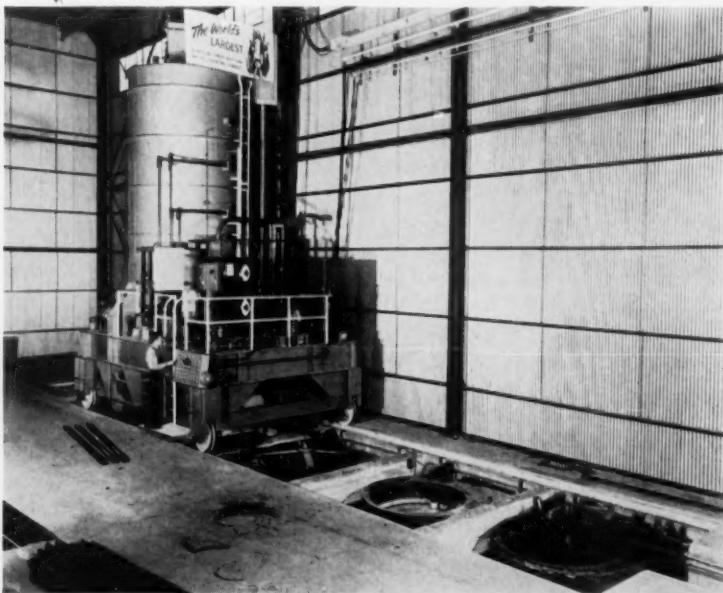
For further information circle No. 25

### New Furnace For Metallurgical, Inc.

What is thought to be the world's largest drop-bottom, metal treating furnace of its type began operation recently at Metallurgical, Inc., Minneapolis, Minn.

Specially designed to vertically heat treat extra long parts, the furnace which has been certified by the U. S. Air Force, hardens, anneals, stress relieves and normalizes steel and aluminum. Controlled endothermic or neutral atmosphere insures bright work and eliminates scaling. Three chart type recording instruments are said to control the furnace temperature within plus or minus five degrees F. to 2200° F. Distortion is kept to a minimum by vertical heating and then quenching in a 22 foot deep temperature-controlled endothermic or neutral atmosphere insures bright work quench reduces distortion up to 90 per cent compared with the conventional oil quench.

The furnace is mounted on a carriage and moves along tracks over a pit, 25 feet deep and 60 feet long. The pit houses three agitator type quench tanks permitting quenching in water, martempering oil or hot salt. The water and oil tanks have a capacity of 6,300 gallons each, while the hot salt tank is charged with 105,000 pounds of molten salt. The distance from the bottom of the pit to the top of the furnace is 55 feet. The furnace, called the "Vertical 752," because of its cubic feet of working space, is 9 1/2 feet wide and 22 feet high and has its own self-contained crane in a gas tight housing. The hook and cable are made of high-alloy, heat resistant metal.



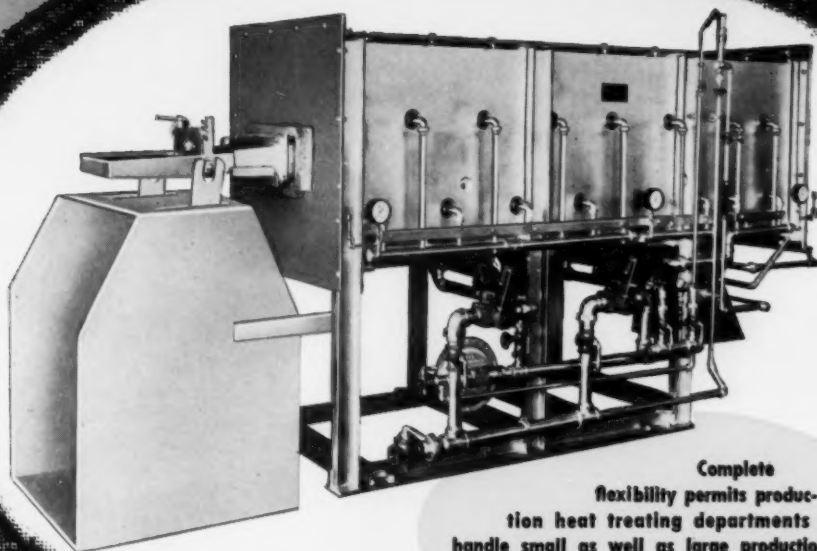
Parts to be hardened are suspended from a fixture in the loading end of the pit, hoisted into the furnace through the bottom, and brought up to the specified temperature for the required time. The operator then moves the furnace over the desired quench—oil, water, or hot salt—and lowers the load into the quench with a speed of from one to ten feet a second. This insures no air cooling. The furnace then returns to the loading station.

Because of its ability to minimize distortion the furnace is already handling large aircraft parts in production runs and has been inspected by several machine tool manufacturers. The furnace was designed by the Loftus Engineering Corporation, Pittsburgh, Pa.

# New RECIPROCATING HEARTH FURNACE

Patent 2,671,654

by AGF Pioneers, the originators and builders of Reciprocating Furnaces since 1921. Features include stationary muffle and complete atmosphere control.



Complete flexibility permits production heat treating departments to handle small as well as large production lots on a continuous basis.

Carburizing, case hardening, Ni-Carb process of ammonia-gas carburizing, clean hardening, etc. of parts ranging from balls for ball point pens to heavy forgings can be accomplished with ease in the same model without any modification.

Newly engineered fully automatic feeding device is now available to eliminate costly work handling in charging the furnace.

Individualized treatment assures uniformity of product. Each piece is individually heated, subjected to the atmosphere and quenched. Disadvantages of batch heating and quenching are eliminated. Work can be observed throughout the processing cycle.

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COMPANY.....

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# HEAT TREATING HINTS

## Spring-Type Holders Used in Heat-Treatment of Drills

The heat-treatment of such tools as twist drills usually involves the use of many different types of holders for suspending the work in the salt-bath furnaces. This problem had received considerable attention in the heat-treatment department of Firth-Brown Tools Ltd. (England), specialists in the production of high-speed steel drills and engineers' small tools. The heat-treatment in general consists of pre-heating to approximately 850° C. (1560° F.), followed by heat-treatment at approximately 1300° C. (2370° F.). Many different types of holder were tried, but none of them gave the ease and speed of handling which the works engineers thought should be achieved.



Fig. 1.—Inserting twist drills into the spring holders.

As so often happens, the solution to the problem is a very simple idea—the use of springs to suspend the work from the holder (as shown in Figs. 1 and 2). The drills or, in fact, any tools with tapered shanks are simply inserted into the springs with a slight twist. The expansion of the end coils results in sufficient tension on the spring to grip firmly. Removal of the tools from the holders is simple, permitting even more saving in labor costs and increasing productivity.

The normal grade of spring steel first used for these springs failed prematurely due to softening by heat flow. Springs made of Nimonic 90 were then tried and immediately proved successful. Life of



Fig. 2.—After preheating to 850° C., the assembly is put into a neutral salt bath at 1300° C.

the springs is so far undetermined, for, although some have been in daily use for nearly a year, the original springs are still as good as new and would appear to be good for several years' service.

*Reprinted from "Metal Treatment and Drop Forging"*

## Tools Should Be Baked After Plating

Electroplating of tools with chromium or nickel is an operation which finds frequent use. Plating is used to salvage tools by regaining worn dimensions, or to correct mechanical errors. It is also used for decorative purposes. Moreover, it is advantageous on some tools for resisting wear or metal pickup.

Plating of hardened tools is a relatively simple operation but can be hazardous if the plating is not followed by tempering, or baking, as it is often called. During deposition of the plated metal, a considerable amount of hydrogen is also deposited on the tool. Some of the hydrogen diffuses into the tool, causing extreme brittleness. If the tool is used immediately after plating, breakage in service may occur. To avoid this possibility, the tool should be tempered at 300/400° F for at least four hours, to restore its original ductility. It is desirable to temper as soon as possible, after plating. Grinding should never be done on the steel itself before tempering. If the tempering is omitted, the tool will gradually recover its ductility at room temperature in from two to three weeks, but will be subject to breakage if used before recovery has occurred.

*Reprinted from "Tool Steel Topics", Bethlehem Steel Company*



## RIGHT OR WRONG IN LABOR RELATIONS (cont.)

*When a layoff occurs does a senior man have to be given a chance to prove he can handle a job held by a junior in another classification?*

### What Happened:

The Company had a policy of plant-wide seniority. The provision which spelled this out read in part:

"... If an employee is being laid off in his classification and has the ability to perform the work in another classification he shall be entitled to perform the work in any other classification providing he has sufficient knowledge. Ability includes job knowledge, experience and efficiency required to perform the job in an average and/or satisfactory manner."

When a layoff came, Hogan, a Helper-Maintenance-Man with 5 years' seniority was told there were no lower or higher available jobs in his classification. In an interview with the foreman Hogan said he certainly wasn't interested in a "lower job" but did want to be up-graded to Labor Grade 9 where a probationary employee with less seniority than Hogan was performing the task. Hogan's position was that he had a right to "bump" a junior in any classification and the Company was obligated to give him a chance to prove his worth. The foreman was called in to interview Hogan regarding his knowledge of Labor Grade 9 work. The supervisor reported that Hogan was *not* qualified, having neither knowledge nor experience necessary to do a satisfactory job.


The union protested that the interview was not enough. It held that the man must be placed on the job, and only after a trial period should an opinion be formed as to Hogan's competency.

Was the Union: Right ☐ Wrong ☐

**What Arbitrator Jim Low Ruled:** "The wording of the contract does not prohibit an employee who is being laid off from seeking to replace a probationary worker, or an employee whom he outranks in length of service, regardless of the job classification or labor grade. The real issue is whether or not Richard Hogan was given a chance to prove that he had the ability, as determined by the degree of job knowledge, experience and efficiency required to perform the job in an average and/or satisfactory manner."

"The arbitrator finds that the Company fulfilled its obligation in the manner that had been its past practice in placements, upgrading and transferring, by checking Hogan's written record for experience; by the foreman discussing the requirements of the job with Hogan; also in discussions with the griev-

(Continued on page 39)







# 330

## HIGH TEMPERATURE TRIANGULAR BARS

from WAREHOUSE STOCK


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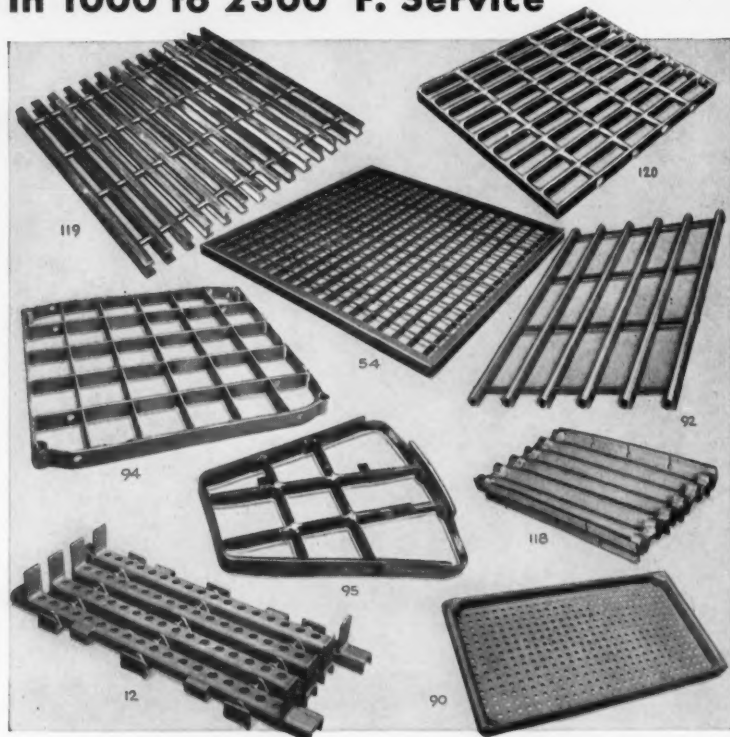
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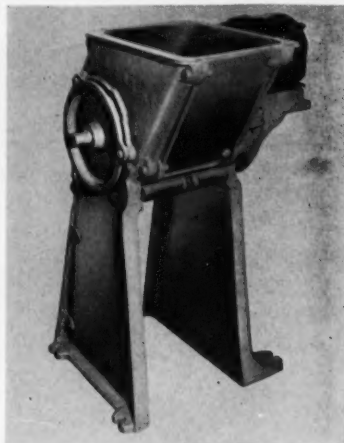
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*For further information circle No. 29*

## **News to Heat Treaters(Cont.)**

Standard 50 pound blocks of dry ice are accommodated by the crusher which rapidly reduces

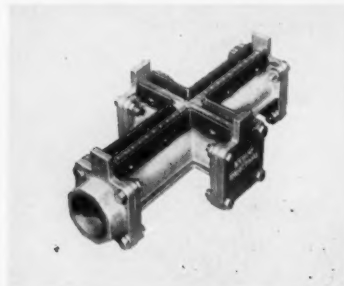


the block in a minute or less. The crusher is powered by a 1 1/2 h.p. motor and requires a 20" x 22" floorspace, weighs 325 pounds.

*For further information circle No. 30*

## **Bryant Burners**

Pyroline burners, recently introduced by Bryant Industrial



Products Corp., Cleveland, Ohio are reported to have excellent flame stability characteristics. Flame retention rails are air cooled to minimize replacement problems.

According to specifications, these burners operate efficiently in air stream velocities of 5000 FPM and up to 40" W.C. mixture pressure. Flame travel is instantaneous from section to section without the need for special attachments. The uniform distribution of heat over wide areas

*(Continued on page 38)*

**METAL TREATING**

# LETTERS

TO THE



EDITOR

Dear Editor:

I am gratified that the articles on "Cost Accounting for Heat Treating" have been received with such widespread interest by the readers of METAL TREATING. The Committee members are indeed appreciative of the many complimentary letters that have been received regarding the articles.

In the most recent issue of METAL TREATING you published a letter signed R. S., Management Engineer. It seems to me that Mr. R. S. has drawn certain erroneous conclusions and made some observations about which I would like to comment.

He states that in the last two articles dealing with the establishment and application of unit costs, some of the accuracy of the first two chapters is being jeopardized by over-simplification and by using data based on experience rather than facts. This statement is somewhat misleading, first, because it fails to give cognizance to the elementary differences between the various phases of cost accounting and second, because it infers that data based on experience should be held in suspect. In my book, facts and data based on experience are the same animal.

Before commenting further, perhaps it would be well to mention that although the subject was divided into four categories for presentation all of the articles represent the combined efforts of the Committee. I might add that while the Committee placed considerable emphasis on the practical aspects of a cost system, it was never willing to compromise dependable unit costs for the sake of simplicity.

In the third article a simple alternative method was described for determining direct labor costs. It was suggested that each productive unit could be rated as to direct labor requirements under normal operating conditions on the basis of experience. It certainly was not intended that such a rating should be a guess, but should reflect actual man power requirements. The direct labor rating is specified as being under normal operating conditions, because labor cost on a furnace or bank of furnaces, fluctuates with the many different jobs that are processed in most heat treating plants. This, however, need not cause serious difficulties in figuring job costs as long as the labor part of a unit rate is clearly defined. The labor component or any of the other parts of the rate can be adjusted to fit the job.

The 20% adjustment factor used in an example

in the third article was a purely hypothetical figure. In each plant this would be based on actual conditions in that plant.

The final step in the process of developing unit costs is the allocation of costs to the productive hours of the equipment. If the period on which the productive hours are based covers normal variations in the level of production (seasonal or otherwise) the resulting unit costs will reflect average burden. Prices based upon such unit rates will uniformly absorb costs which vary with normal fluctuations in volume. Of course, a lean period resulting from a general business recession is a horse of a different color. Unabsorbed burden during such a time is a problem for the budget director.

K. U. JENKS, Chairman  
Cost Accounting Committee,  
Metal Treating Institute  
(Lindberg Steel Treating Company,  
Chicago, Ill.)

*Ed.—Glad to see this stimulating, friendly controversy concerning the Cost Accounting papers which appeared in METAL TREATING. Comments and controversy regarding any article will always be welcome.*

Gentlemen:

Our chief metallurgist has requested that we correspond with you relative to being placed on your mailing list for your monthly publication of METAL TREATING.

We feel that this publication will be invaluable to our metallurgical engineering staff and shall be pleased to make your publication available to them at all times.

Please mail the publication to the attention of Mr. Patrick Settani, Chief Metallurgist, Eaton Manufacturing Company, Aircraft Division, Battle Creek, Michigan.

J. R. STINER, Employee Relations Manager  
Eaton Mfg. Co.  
Aircraft Div.  
Battle Creek, Mich.

*Ed.—Mr. Settani becomes a regular reader with this issue.*

Gentlemen:

One copy of your magazine is being regularly mailed to Mr. F. E. Foster who formerly was metallurgical Engineer for the Grinnell Corporation. Since Mr. Foster is no longer associated with this company and the writer has taken over his duties, I would appreciate it if all future issues are addressed to my attention.

I find your magazine most interesting and look forward to the receipt of forthcoming issues. In fact, one of these days we would be glad to contribute an article on heat treating and stress relieving of piping.

HELMUT THIELSCH  
Metallurgical Engineer  
Grinnell Co.  
Providence, R. I.

*Ed.—Change made; hope to have article in near future.*

### News to Heat Treaters (Cont.)

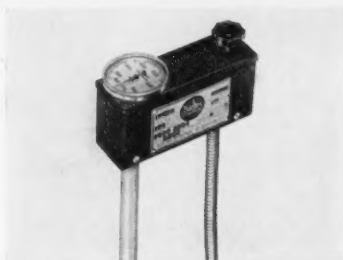
is possible using the cross, 90° elbow, bottom inlet, side inlet, and straight sections. A universal pilot mounting bracket for single point ignition and flame protections bolts to any flange on either side of the burner.

*For further information circle No. 32*

### Indicating Temperature Control

Burling Instrument Company, Chatham, N.J., has announced

an indicating temperature control, Model LD-1S, which combines an independent dial ther-



mometer with a differential expansion type temperature control.

Several adjustable temperature ranges are offered, including 150-750° F. Control is obtained by the differential expansion of two concentric tubes actuating a snap-acting switch through a lever. Switch is rated at 15 amp, 125-250 volts, a.c. Operating differentials are from  $\pm 1^\circ$  to  $4^\circ$  F., depending on conditions.

*For further information circle No. 34*

## *low cost, gas-fired* *hot salt or hot oil* **QUENCHING UNIT**



**UNITS BUILT  
FOR SPECIAL  
REQUIREMENTS**

**WRITE FOR  
ADDITIONAL  
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Built to operate in the range from 300 to 800 Deg. F., for Martempering and Austempering.

Salt or Oil temperature is closely held by unique design features.

Full Uniform circulation of the hot quenching medium in the quenching area further reduces distortion.

High temperature salt separator for "Carry Over" salt is also available.

Standard unit has a usable quenching space 17" x 19" x 27" deep.

**INDUSTRIAL HEATING EQUIPT. CO.**  
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*For further information circle No. 33*

### Washing Compound

The Van Straaten Chemical Company, Chicago, Ill., has announced test results on a new compound for use in washing operations to prepare parts for atmosphere treatment. The compound, Vantrol 5614-B, was tested against a previously used mixture of caustic soda, phosphates, solvents, wetting agents, etc. During production, normal washer temperature was 180° F. and parts were washed for 40 seconds using 1 1/2 ounces of solution per gallon of water. According to the test report fair results were being obtained with the old solution and parts were not completely clean.

With the new compound used in the same concentration with identical temperature and time cycle, the manufacturer reports that all traces of oil and dirt were removed. The report states further that elimination of all soil has reduced atmosphere control problems to a minimum at the test plant.

*For further information circle No. 35*

### Brazing Flux

A special flux for silver alloy brazing of stainless, chromium heat resisting alloys, chromium and tungsten carbides is being offered by Handy & Harman, New York, N. Y. Called Special Handy Flux Type B-1, the new flux is designed to reduce oxides of the refractory metals while protecting the underlying metal.

*For further information circle No. 36*



## RIGHT OR WRONG IN LABOR RELATIONS (cont.)

ant and the Union as to whether or not he had the "ability" to satisfactorily do the work in Labor Grade 9 classification that was occupied by a probationary worker. "In the absence of anything in the Contract that determines who had the final right to evaluate the ability of Richard Hogan to satisfactorily meet the required specifications of the jobs in the higher labor grades, the Arbitrator has based his judgment on the presented facts, which include the practice the Company has used in the past, and he is impelled to rule that Richard Hogan was given the customary "chance to prove his ability on any other job which he had seniority on, which he claims he can perform" and that the Company was within its rights when it decided that the grievant did not possess the necessary "ability." The complaint of the Union is not justified."

*Can an employee be disciplined for not giving a reason for his absence?*

### What Happened:

Herman Proehl called the company five hours prior to starting time and left word for his foreman that he would not be in to work on the shift. On his next tour of duty, when he returned, his foreman asked why he had been absent. Proehl said "personal reasons" and refused to elaborate. He was given a 3-day layoff. When the case came to arbitration, the union defended the employee by citing a company rule: it said that a worker can be disciplined if he "fails to notify the company when absent from work or fails to give satisfactory reasons for such absences." "The worker," said the union, "doesn't have to do both." Proehl notified in advance, and therefore fulfilled the obligation required of him.

Was the Union: Right ☐ Wrong ☐

**What Arbitrator Walter G. Seinsheimer Ruled:** "This arbitrator reluctantly finds that Mr. Proehl has complied with the contract as written. The contract does not specifically say that he must notify the company four hours in advance and present a reasonable excuse. It is obvious to this arbitrator that Mr. Proehl has taken advantage of the wording of the contract, and that unless the contract is changed in the future, the same advantage can be taken by anyone who so desires.

"Under the facts and circumstances of this case, Mr. Proehl, not having violated the letter of the contract should not have been given a 3-day suspension.

"Therefore, the company should reimburse Mr. Proehl for the 3 days." ■ ■ ■

For precision cleaning  
of molds and dies—

## NEW PANGBORN HYDRO-FINISH

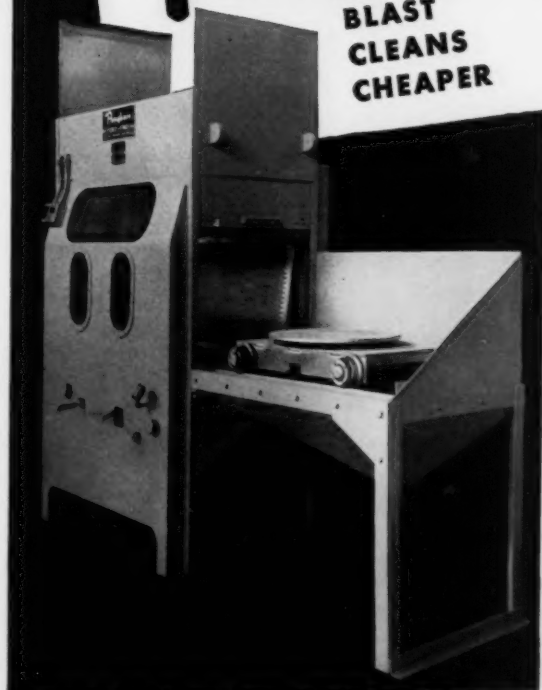
gives you: Fewer moving parts  
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Now Pangborn's famous Hydro-Finish is yours with added convenience and efficiency! Holding fine tolerances, Hydro-Finish cleans molds and dies in minutes . . . offers many new advantages. Pangborn has done away with the pump; air jet sluriators now keep the abrasive in suspension. This means a lower investment and fewer moving parts. Optional loading stand simplifies handling, washing and inhibitor application. The cabinet has been redesigned for more efficient operation. These and other advantages make the new Pangborn Hydro-Finish ideal for precision cleaning and finishing!

For further details on Hydro-Finish, send for Bulletin 1402 now! Write: PANGBORN CORP., 3600 Pangborn Blvd., Hagerstown, Md.

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For further information circle No. 37

# Burning Issues

Eclipse

Published by Eclipse Fuel Engineering Company  
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Eclipse Pressed Steel Pots are gaining acceptance everywhere because they combine low cost, faster heating and totally dependable operation. Formed from "heart-of-the-ingot" steel, these low cost pots are not subject to grain growth at red heat . . . are free from hidden defects and weld spots that fail unexpectedly. Special "Metalized" pots also are available to give you maximum protection against heat oxidation and scaling at high temperatures and greatly extend service life.

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Circle  
No. 38

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For further information circle No. 39

## INSTITUTE NEWS (cont.)

quiries from members concerning the various courses available through ICS with the intention of the company's paying the expenses for the courses for some of their outstanding apprentices.

In addition, the following letter was received from Mr. Joseph J. Stromski, an employee of the Greenman Steel Treating Company, Worcester, Mass. This letter is so gratifying and of such interest to the Institute, that it is printed here in its entirety:

Metal Treating Institute  
271 North Avenue  
New Rochelle, New York

Attention—Mr. C. E. Herington  
Executive Secretary

Dear Mr. Herington:

I would like to take this opportunity to thank you again for the privilege of being able to enter the competition for the scholarship offered jointly by you and International Correspondence Schools, and also to extend my congratulations to the winner.

It would have sufficed just to compete, honestly giving all qualifications and being judged by a fair and impartial jury. For this is the American way of doing things.

Your letter informing me of my not being chosen was presented nicely which I appreciated.

That part which followed, for which I am most honored and grateful, came to my attention when Mr. Lloyd Field, my boss, called for me and discussed the possibilities of my taking this course with some aid from my company, as per your recommendations.

This action on the part of you gentlemen of the Metal Treating Institute awoke in me the realization of what a fine association my company is part of. In this troubled world of ours, it is gratifying to know that an individual, no matter how insignificant he may seem, is shown such courtesy and interest.

It is with humility that I say, I am proud to be a small part of an organization that is dedicated to help all of its membership, to improve and perfect the facilities of this and all associated industries and if need be, muster all of its resources to preserve the ideals and principles of our American way of life.

Gentlemen, I sincerely thank you.

Yours truly,

JOSEPH J. STROMSKI  
Gardner Road  
Hubbardston, Mass.

■ ■ ■



# Tool Steel Topics



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributors: Bethlehem Steel Export Corporation



## Keen Edges Hold on Blades of Lehigh H and L

The shear blades shown here are representative of the blades used in pairs in power squaring shears manufactured by Wysong & Miles Company, Greensboro, N. C. The blades are hollow ground, and are made of either Bethlehem Lehigh H or Lehigh L tool steel. They perform economically at speeds up to 60 strokes per minute because they hold their cutting edges for long periods of time, in this way minimizing the need for frequent regrinding.

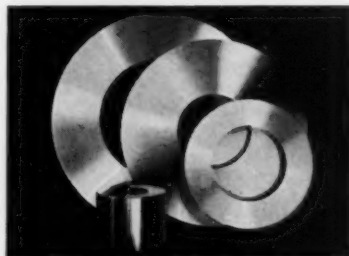
Lehigh H and Lehigh L are high-carbon, high-chromium tool steels. They form high-chromium carbide concentrations, meaning the ultimate in wear.

With its lower carbon content and addition of 1.00 pct nickel, Lehigh L has unusual toughness. It is used for shearing thicker material where shock is involved.

### TYPICAL ANALYSES

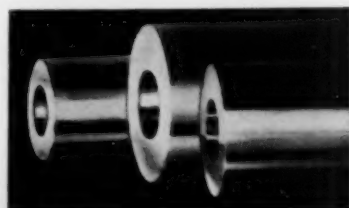
	C	Cr	Mo	V	Ni
Lehigh H	1.55	11.50	0.80	0.40	—
Lehigh L	0.85	11.50	0.45	0.30	1.00

You can count on good wear-resistance with Lehigh H or Lehigh L. If you would like to have more information about these steels and their use, we suggest that you contact your tool steel distributor, or write direct to us at Bethlehem, Pa.



## HOLLOW-BAR TOOL STEEL IS IDEAL FOR RING-TYPE APPLICATIONS

BTR (Bethlehem Tool Room) Hollow-Bar is an excellent steel for hardened bushings, ring dies, draw rings and similar uses (above). It is produced by high-speed trepanning, in which hammer-forged or hot-rolled round bars (below) are cored out, followed by rough turning on the outside. Hollow-Bar saves production time, for there's no need to wait for forged rings or discs. Quick delivery, too, for rings can be cut to any length.



### BETHLEHEM TOOL STEEL ENGINEER SAYS:

#### *First Harden the Die, Then the Punch*

In making up special punch-and-die sets, the fitting of the punch and die after hardening often involves hand grinding or stoning to remove the size changes produced during the hardening operation. The hole in the die will often close in, while the punch will usually expand in diameter. Thus the two parts will not fit, or will lose clearance.

In order to minimize such difficulties, and to reduce tool costs, the use of the following procedure is recommended:

1. Make up the die, and harden it.
2. Make up the soft punch, and fit it to the die.
3. Harden punch.
4. If necessary, fit punch to die by grinding.

In this way, only one of the two parts is ground in the hardened condition, and the grinding is external and easier than internal grinding. To avoid excessive grinding, it may occasionally be advisable to allow for size-change in the die. But in the main this procedure can bring worthwhile economies.

# METAL TREATING

## EQUIPMENT and MATERIALS DIRECTORY

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49th Street and A. V. R. R.  
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ECLIPSE FUEL ENGINEERING CO.  
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GENERAL ALLOYS COMPANY  
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New York 5, New York

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11300 Schaefer Highway  
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ARMOUR AND COMPANY  
AMMONIA DIVISION  
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Pittsburgh 1, Pennsylvania

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Philadelphia 33, Pennsylvania

PARK CHEMICAL COMPANY  
8076 Military Avenue  
Detroit 4, Michigan

SUN OIL COMPANY  
Industrial Products Department  
Philadelphia 3, Pa.

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### REFRACTORIES

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2301 Blake Street  
Denver, Colorado

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### SALTS

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Branford, Conn.

ECCO CHEMICAL CORPORATION  
19th Street & Park Avenue  
Weehawken, New Jersey

THE A. F. HOLDEN CO.  
11300 Schaefer Highway  
Detroit 27, Mich.

E. F. HOUGHTON & CO.  
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### TEMPERATURE CONTROLS

METAL & THERMIT CORP.  
100 East 42nd Street  
New York 17, New York

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### TOOL STEELS

BETHLEHEM STEEL COMPANY  
Bethlehem, Pennsylvania

CRUCIBLE STEEL COMPANY OF AMERICA  
Pittsburgh, Pa.



# MANUFACTURERS' LITERATURE

For your copy circle  
the number on the  
Readers' Service Card

## HEAT TREATING HINTS

The Lindberg Engineering Company, Chicago, Ill., regularly distributes an informative folder entitled "Heat Treating Hints." The folder presents technical data on heat treating processes as well as hints for solving difficult or unusual problems. The folder is available to all persons engaged in heat treating.

For further information circle No. 41

## MILLIVOLTMETER PYROMETERS

The Bristol Company, Waterbury, Conn., has just published a new bulletin, P1244, on their complete line of millivoltmeter pyrometers and accessories. Included in the bulletin are the new Model 580 indicating pyrometers for service up to 4000° F., indicating controllers with mercury switches or Thyratron-operated relays, and portable indicating pyrometers. Also included are two-point and multiple-point pyrometer switches for use when a single indicator is intended to monitor temperature measurements from more than one station.

For further information circle No. 42

## ALLOY RESISTANCE TO GASES

To aid designers in the intelligent use of high alloy castings, the Alloy Casting Institute of Mineola, New York, has just made available reprints of the paper, "Resistance of Cast Fe-Cr-Ni Alloys to Oxidizing and Reducing Flue-Gas Atmospheres" by J. H. Jackson, C. J. Slunder, O. E. Harder, and J. T. Gow. Reprinted from the *Transactions* of the ASME, the paper is seven pages long and includes numerous figures.

In this paper, attention is directed toward the influence of sulfur content on corrosive attack by hot gases, a subject of interest in many applications, such as furnaces, boilers, and gas turbines, where fuels containing sulfur are burned. It is a complete report of the comprehensive series of tests made at the Battelle Memorial Institute.

For further information circle No. 44

## SOFT-METAL MELTING

A guide for the selection of heating equipment and control for soft-metal melting applications is offered by the General Electric Company, Schenectady, N. Y.

Designated GEA-6113, the four-page publication shows steps for the selection of cast-in immersion heaters for melting specific types of metals, and varying quantities of each type. A second section describes the thermostats and manual or automatic controls available for each heater.

Another section of the guide is devoted to the selection and application of soft-metal melting pots. The bulletin is illustrated throughout.

For further information circle No. 45

## HEAT TREATING FACILITIES

The J. W. Rex Company, Lansdale, Pa., has published a booklet entitled "New Horizons For Metals," which provides complete information on their facilities for heat treating and metal conditioning. Various types of equipment for many different processes are illustrated along with facilities for testing and inspection.

For further information circle No. 46

## PREHEATING CHART

Tempil Corp., New York, N. Y., has published a preheating chart listing the recommended preheat temperatures for 79 commonly used metals and alloys. Plain carbon steels, high tensile steels, medium chrome moly steels, and plain chrome steels are some of the metal groups for which approximate compositions and recommended preheat temperatures are shown. Factors influencing temperatures and the desirable effects of correct preheating on metal properties are enumerated.

For further information circle No. 47

## NITRALLOY AND NITRIDING

The Nitralloy Corporation of New York offers a 48-page, two-color booklet entitled "Nitralloy and Nitriding, Including The New Floe Process."

Seventeen charts and five graphs help to define compositions, mechanical properties and case hardening capabilities of four principal types of the special Nitralloy steels. A two-stage procedure for using the new Floe process is described, together with a comparison of results utilizing that method over the original Fry process.

For further information circle No. 48

## HOT SALT QUENCH

The Ajax Electric Company, Philadelphia, Pa., has published bulletin No. 700 describing "Cataract" quench furnaces. The bulletin describes the operation of the new unit and includes specifications for equipment with and without salt separating chambers.

For further information circle No. 49

## PRECISION CLEANING

Precision cleaning and finishing is the subject of a comprehensive brochure just published by American Wheelabrator & Equipment Corp., Mishawaka, Ind. Dealing with the wet abrasive blasting process, the 18-page booklet presents 40 frequently-met applications in which this process can be profitably used. Most of them are illustrated.

A section of the brochure is also devoted to describing the process, itself, in which water-suspended abrasives are thrown at high velocity upon the work. The necessary equipment is also mentioned, together with the fact that tolerances of .0001" can be maintained on work where necessary.

*For further information circle No. 50*

## HARDENABILITY OF STEEL

The Crucible Steel Company of America has announced the availability of a 12 page paper by Mr. Peter Payson, entitled, "Hardenability of Steel." Included is a complete discussion of the Jominy hardenability test and its method of use for hardenability specifications.

*For further information circle No. 51*

## PIPE CONNECTIONS

A 12 page, combination engineering manual and catalog completely describes the Graloc line of universal pipe connections, unions, and bleeder valves. Describing all-steel sealing with a pressure-aided seat, termed the "Graloc principle," the book shows how this principle has been incorporated into a pipe connection and union covering a range from 1/2" to 12".

Descriptions are given of applications said to simplify and improve piping systems. In addition it gives complete data on construction, operation, advantages, specifications, dimensions, pressure ratings and prices.

*For further information circle No. 52*

## FURNACE BULLETINS

Industrial Heating Equipment Company, Detroit, Mich., has published two new bulletins describing continuous, semi-continuous and batch-type furnaces. Bulletin 13-A covers continuous-type recirculating furnaces and provides data on furnace operation as well as typical applications. Bulletin 19 covers a variety of controlled atmosphere furnaces and illustrates a number of installations now in operation.

*For further information circle No. 53*

## TEMPERATURE CONTROL

The Burling Instrument Company, Chatham, New Jersey, has issued Bulletin 105, the fifth in a series describing their line of temperature controls.

This bulletin covers Models VD-2S, VD-2C, and VD-2X. Each of these is a dual temperature control, incorporating two independent electric switches for operation up to 1800° F. The models differ only in type of enclosure—standard, weathertight, or explosion proof.

*For further information circle No. 54*

## AIRLESS BLASTING

A new bulletin, No. 124-B, on the 48" x 42" Wheelabrator Tumblast, an airless blast cleaning machine employing the tumbling principle in conjunction with the hurling of metallic or non-metallic abrasives, has been published by American Wheelabrator & Equipment Corp., Mishawaka, Indiana.

Individual sections of the bulletin are devoted to the following subjects: (1) a discussion of airless abrasive blasting in general; (2) the component parts of the Tumblast; (3) electrical, mechanical, and size specifications; (4) installation views of machines, plus photos of typical parts being processed in them; and (5) a set of case histories, giving actual performance data experienced by users of the Tumblast.

*For further information circle No. 55*

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operates baths trouble-free  
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Gray-iron cylinder sleeves are hardened in self-rectifying AEROHEAT 1000 up to 500 Brinnell to meet customer service conditions. Tempering is done in a nitrate/nitrite bath of AEROHEAT 300. Regular additions to each bath have kept both operating trouble-free for more than five years, with excellent electrode life. This is two years longer than normal life expectancy of high-temperature ceramic pots—a tidy bit of maintenance cost-saving.

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MT 3-55

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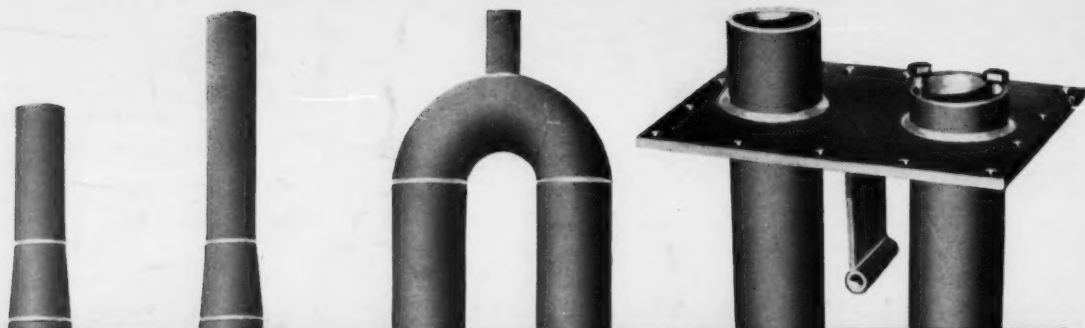
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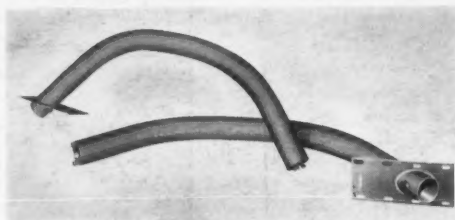
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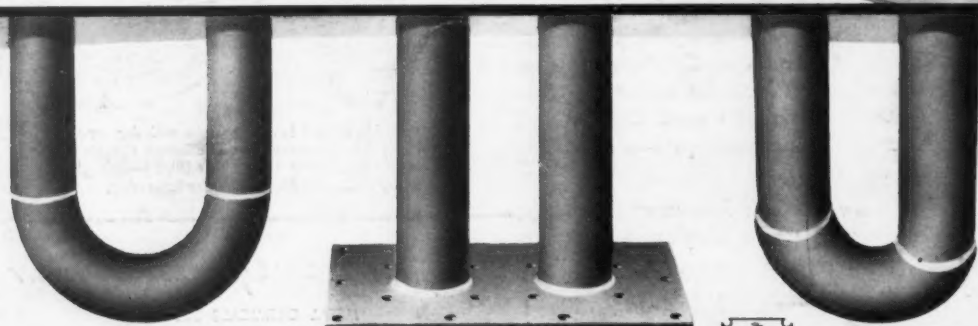
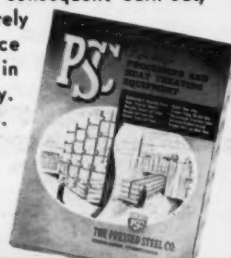
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*For further information circle No. 57*



